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Factorial Validity of the Team Skills Scale as used for Geriatric Interdisciplinary Team Training (GITT)

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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Dedication

This dissertation is dedicated to the memory of my mother, Rosalyn Tiller Owens,

February 15, 1925 to December 3, 2003.

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I thank the members of my dissertation "team" for facilitating this journey: Thomas T.T.H. Wan, Constance L. Coogle, and John James Cotter, for their helpful encouragement and stimulation during my work on this study. I also thank my dissertation Chair, Iris A. Parham, who has always been there supporting my every effort from the day that I enrolled in the Gerontology Masters program in 1994.

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I owe an enormous debt of gratitude to my nephews and nieces who are my joy: Lamont, Stephanie, Denita, Karmaan, Aron, Aronda, Dara, Malik, and Diarra. I hope that this accomplishment inspires you to keep reaching for good things and to always say, "Yes, I can."

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Abstract

FACTORIAL VALIDITY OF THE TEAM SKILLS SCALE AS USED FOR GERIATRIC INTERDISCIPLINARY TEAM TRAINING (GITT)

By Myra G. Owens, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

Virginia Commonwealth University, 2006.

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Objective: To examine the factorial validity of the Team Skills Scale (TSS). The TSS is a 17-item scale developed by Hepburn, Tsukuda, and Fasser (1996). The Scale is purported to assess self-perceived team skills.

Data Source: Data for this study were provided by The New York University Geriatric Interdisciplinary Team Training (GITT) Resource Center and were collected as part of the evaluation of the GITT program. The data were collected between January 1997 and June 2000.

Study Design: This quasi-experiential study was focused on the trainee (N=1,715) as the unit of analysis. The Model of Individual-Level Team Competencies (Model of I-LTC) served as the conceptual framework and guided a priori specification of the TSS

confirmatory factor analysis measurement model. The Model of I-LTC was developed by this author based on review and interpretation of the team literature.

Principal Findings: The TSS is a one-factor structure comprised of eight of the original 17 indicators. Also, the revised measurement model was found to be invariant when the data were randomly divided into two equal samples. Finally, the covariance structure model indicated that attitude about the physician as team leader and sole patient care decision-maker had a significant and negative association with variation in responses to the TSS. Attitude about the quality of team delivered patient care had a significant and positive association with variation in responses to the TSS.

Conclusion: This study found that the TSS in a single factor structure comprised of eight of the original 17 TSS items. It is believed that the eight items measure self-perceived team collaboration skills. Although the factor structure was confirmed by the data, this does not mean that the proposed structure is absolute. It just means that the structure has not been falsified. However, it is possible that this constellation of indicators was data driven. Therefore, further psychometric testing, to include the use of other data sources, is recommended.

Keywords: geriatric interdisciplinary team training; GITT; team skills scale; teamwork competencies; self-perceived team skills, teamwork knowledge skills and abilities; self-perceived team collaboration skills; team collaboration skills

CHAPTER 1: INTRODUCTION

The United States healthcare system experienced almost continuous incremental structural and cultural changes during the 1980s and 1990s (Light, 1997; Shi & Singh, 1998) and many more changes are expected during the first twenty years of the 21st Century (Institute of Medicine, 2001). Population aging, together with rising healthcare costs have been cited as the primary reasons why changes are needed. Americans are living longer and the healthcare system is positioning itself to manage the impact of population aging. The greatest impact will occur during the first 30 years of the 21st Century when Americans born between 1946 and 1964 will become the largest cohort of older adults that has ever existed in the United States (U.S. Department of Health and Human Services, Administration on Aging, 2003). There is concern that healthcare costs will continue to grow dramatically. Per capita expenditures for older adults living in the community were more than three times those of individuals under the age of 65 in 1996—$5,644 vs.$1,865 and are projected to increase to $7,674 (in 1996 dollars) by 2006 (Agency for Healthcare Research and Quality Task Force on Aging, 2001). Clearly, cost containment pressures and the anticipated demand for geriatric healthcare services are informing the ways in which the healthcare system is being restructured.

The ongoing changes in the healthcare system has led many healthcare leaders to argue that health professionals are not adequately prepared to participate in the emerging

21st century healthcare system and particularly the need for patient centered geriatric care (Agency for Healthcare Research and Quality Task Force on Aging, 2001; Greiner, Knebel, & the Committee on the Health Professions Education Summit, 2003; O'Neil & Pew Health Professions Commission, 1998; Shugars, O'Neil, & Bader, 1991). The emerging healthcare system is expected to be patient centered and will require practitioners to work in interdisciplinary teams. Yet, most healthcare practitioners have not received training that would facilitate the shift towards patient focused care; nor have they received training to support the acquisition of interdisciplinary teamwork skills.

However, an early responder to the need for interdisciplinary team training and patient focused geriatric care was The John A. Hartford Foundation. Beginning in 1994, the Foundation funded thirteen projects to develop models for Geriatric Interdisciplinary Team Training (GITT). Subsequently, eight of those projects received three-year (1997-2000) grants to implement their geriatric interdisciplinary team training models (Siegler, Hyer, Fulmer, & Mezey, 1998). While all eight GITT programs consisted of both didactic and clinical teaching approaches and used the same core program evaluation measures, the design and implementation of the programs varied.

According to the *Geriatric Interdisciplinary Team Training Implementation Manual* (2001), among the eight sites there were three general models of teaching geriatric interdisciplinary team care: Academic Model, Clinical Model, and Mixed model. In the academic model, geriatric teaming courses were taught for credit. Geriatric team training was presented in clinical settings as the name of the model

indicates. The mixed model combined academic courses with clinical training. Data to support this dissertation came from the evaluation of the eight GITT programs.

Key Study Definitions and Competencies for 21st Century Healthcare Professionals

In addition to restructuring direct services paradigms, reforms must be made in the ways that the health related professions educate and train students and practitioners to address the needs of older adults and vulnerable populations. A number of commissions, associations and foundations have issued reports identifying competencies that practitioners will need for full and effective participation in the emerging 21st century healthcare system. In all of these reports, interdisciplinary healthcare team skills emerged as a core competency area within a larger framework of competency-based education (Greiner, Knebel, & the Committee on the Health Professions Education Summit, 2003; O'Neil & Pew Health Professions Commission, 1998; Shugars, O'Neil, & Bader, 1991).

The following definition of an interdisciplinary healthcare team (IHCT) as proposed by Drinka and Clark (2000) is adopted for the purposes of this study.

> An IHCT integrates a group of individuals with diverse training and backgrounds who work together as an identified unit or system. Team members consistently collaborate to solve patient problems that are too complex to be solved by one discipline or many disciplines in sequence. In order to provide care as efficiently as possible, an IHCT creates formal and informal structures that encourage collaborative problem solving.

> Team members determine the team's mission and common goals; work interdependently to define and treat patient problems; and learn to accept and capitalize on disciplinary differences, differential power, and overlapping roles. To accomplish these they share leadership that is appropriate to the presenting problem and promote the use of differences for confrontation and collaboration. They also use differences of opinion and problems to evaluate the team's work and its development. (p. 6)

The above IHCT definition clearly delineates the purpose, structure, interdependence, coordinated effort, leadership, and power parameters that distinguish IHCT teams from other types of teams. Additionally, the definition's key elements distinguish the interdisciplinary approach from the multidisciplinary approach. Under the multidisciplinary approach, the efforts of each discipline occur in a parallel or sequential manner: there may be little or no awareness of the efforts of other disciplines and patient care decision-making is vested in one person, usually the physician, rather than the team (Garner & Orelove, 1994). In essence, the IHCT approach is a significant departure from the traditional medical model because team members consistently collaborate, determine the team's mission and common goals, work interdependently and the team shares responsibility for patient outcomes.

To work as an IHCT, healthcare trainees and professionals must acquire teamwork competencies. Competency as defined by the U.S. Department of Education (2002) is: "…a combination of skills, abilities, and knowledge needed to perform a specific task" (p. vii). Competencies "…are the result of integrative learning experiences

in which skills, abilities, and knowledge interact to form bundles that have currency in relation to the task for which they are assembled" (p. 7). Knowledge, skills and abilities (KSAs) are developed through learning experiences. These experiences should include standards for judging competence, opportunities for mastering KSAs, and systematic procedures for assessing acquisition of the stated competencies (Kirkpatrick, 1959, 1998a, 1998b).

Interdisciplinary Education and Team Training

To establish effective IHCT, teamwork must be viewed as an individual skill. That is to say, each healthcare professional must learn the combined conceptual knowledge and practical skills and behaviors required for successful team interaction. Interdisciplinary education seeks to develop the individual's ability to function interdependently with other professionals (Cooksey, 1994; Ducanis & Golin, 1979; Grant, Finocchio, & California Primary Care Consortium Subcommittee on Interdisciplinary Collaboration, 1995). Interdisciplinary education refers to students learning together across disciplinary boundaries, departments and programs. Although the literature contains many articles arguing the benefits of an interdisciplinary education, there have been few rigorous studies of its actual impact on student learning.

Development of interdisciplinary education and training opportunities has, for the most part, followed funding opportunities. Most funding opportunities have been in the field of gerontology (Holmes, 1999; Lavin, Ruebling, Banks, Block, Counte, & Furman, et al., 2001). The Department of Veterans Affairs (V.A.) Administration was an early leader in the development of geriatric Interdisciplinary Team Training Programs (ITTP)

(Baldwin, 1997; Heinemann, 1994). The initial interdisciplinary training demonstration within the V.A. included twelve clinical training programs focused on geriatric care. The success of these demonstrations led to program expansion. By the year 2002, interdisciplinary teams and educational programs were well established throughout V.A. medical centers in both geriatrics and primary care.

The John A. Hartford Foundation has also been a leader in advancing interdisciplinary team training through the funding of GITT programs. In its 2002 Annual Report, The John A. Hartford Foundation stated the following:

> First-rate geriatric care is, by definition, team care. That is to say, older patients with complex, chronic conditions require an interdisciplinary team of health professionals to provide a wide range of medical as well as psychosocial support services, to develop a treatment plan, track a patient's progress and coordinate care across clinical settings. (p. 1)

It was not until the late 1990s that accrediting organizations began including the ability to practice as a member of an interdisciplinary team as a core competency (American Council on Pharmaceutical Education, 2005; Accreditation Council for Graduate Medical Education, 1999; National League for Nursing Accrediting Commission, Inc., 2004). Yet, these accrediting organizations have not addressed actual training requirements for the acquisition of interdisciplinary team competencies (Greiner, et al., 2003). In contrast, accreditation of geriatric medicine fellowship programs requires that fellows receive training in interdisciplinary team didactic and clinical settings (Bernard, 1997).

Interdisciplinary education programs have been reported to result in innovations in team training (Holmes & Osterweis, 1999), diffusion of curricula throughout healthcare academic programs (Baldwin, 1996, 1997; Holmes, 1997; Holmes & Osterweis, 1999) and positive attitude change toward the competence and professional contributions of other disciplines (Cooper, Carlisle, Gibbs, & Watkins, 2001; Long, 1996; Parsell, Spalding, & Blight, 1998). Coogle, Parham, Cotter, Welleford, and Netting (2005) found that healthcare professionals who received four or more hours of geriatric interdisciplinary team training reported significant improvement team skills and attitude about the utility of time spent on the team approach to patient care.

Notwithstanding, a number of studies and literature reviews have indicated that there are no controlled studies or long-term follow-up studies demonstrating that interdisciplinary education works in terms of positive impact on transfer of learning to practice environments or impact on patient outcomes such as functional status and perceived quality of life (Barr, Hammick, Koppel, & Reeves, 1999; Coogle, Parham, Welleford, & Netting, 2002; Cooper, Carlisle, Gibbs, & Watkins, 2001; Greiner, et al., 2003).

Problem

Assessing student acquisition of interdisciplinary team competencies requires methods for evaluating what students have learned. Behavioral observation tends to be the method most often used for assessing individuals within the team context. However, observational methods tend to be/are labor and time intensive. As an alterative, several interdisciplinary healthcare team investigators (Hepburn, Tsukuda, & Fasser, 2002;

Stahelski & Tsukuda, 1990) have developed self-report paper-and-pencil questionnaires as an alternative or supplement to observational methods for assessing geriatric IHCT skills. These self-report questionnaires are in the early stages of psychometric testing. Nonetheless, they hold promise as tools for evaluating the extent to which learners have acquired teamwork skills. The Team Skills Scale (TSS), developed by Hepburn, Tsukuda and Fasser (2002), is one such questionnaire.

The TSS purports to measure a trainee's *perception* of her/his geriatric interdisciplinary team skills. Task specific self-perception of what one can do is more generally referred to as self-efficacy. Self-efficacy refers to a person's belief in how well she/he can accomplish a task or group of tasks (Bandura, 1997). Bandura (1997) and Pajares (2003) have summarized the wealth of evidence supporting the argument that self-efficacy is a predictor of actual performance. Additionally, positive self-perceptions have been linked to persistence with desirable behavior changes (Ajzen, 1991; Bandura, Adams, & Beyer, 1977). Thus, the TSS is potentially a one-of-its kind questionnaire that captures information relevant to the assessment of interdisciplinary healthcare team skills gained from curriculum-driven learning experiences.

The result from one exploratory factor analysis (EFA) of the TSS has been reported (Hyer, Heinemann, & Fulmer, 2002). Although EFA can suggest underlying patterns in the data EFA does not rely on any a priori theory regarding item groupings or possible second-order variables. Alternately, structural equation modeling seeks to test data against the hypothesized or theoretical model and provide an alternative to EFA.

The utility of the TSS as an indicator of what students have learned is contingent upon empirical evidence of its factor structure.

Purpose

The primary objective of this nonexperimental study is to assess the factor structure of the TSS using data that was collected as part of the GITT program evaluation. Factorial validity is a form of construct validity that examines the factor structure of an instrument and answers the question: "Is the factor structure valid?" Analysis of TSS factorial validity requires development of a conceptual framework to guide this inquiry. A conceptual model of individual-level team competencies, developed by the author, will serve as the framework against which TSS data will be evaluated to determine how well the data fits the Scale.

Theoretical Framework

To date, very little work has been done to conceptualize and empirically validate dimensions of individual-level team competencies. There are, however, several interdisciplinary healthcare team taxonomies (Heinemann & Garner, as cited in Heinemann, 1994; Stahelski & Tsukuda, 1990) which focus on the team as the unit of analysis. While these taxonomies have been developed by distinguished researchers and practitioners, there has been no further evolution of the taxonomies such as conceptual frameworks or theories.

The conceptual Model of Individual-Level Team Competencies (Model of I-LTC) developed for this study is largely the judgment of the author and is based on review and interpretation of the small group literature across multiple disciplines and fields. It is

proposed that individual-level competencies affect team interaction and can be understood by a model composed of four dimensions: predisposing factors, knowledge of group process, technical/professional abilities and leadership communication skills.

Predisposing factors refer to the individual's inclination to perceive teamwork as positive interdependence of group members. Predisposing factors can be operationalized by measures of respect for individuals, attitude towards teamwork, satisfaction with one's healthcare role, satisfaction with prior team experiences, diversity, the team's external environment, personality factors, and team size.

Knowledge of group development, dynamics and process is a necessary antecedent of effective interaction with other team members and facilitates cooperative team behaviors. Group development refers to the way groups form, change over time, interact, achieve its goals or fail to achieve its goals, and disbands (Tuckman, 1965; Tuckman & Jensen, 1977). The term group dynamics refer to the types of interaction that take place within the group; and the term 'group process' refers to how the group carries out its procedural functions such as goal setting and agenda making (Brannick, Roach, & Salas, 1993; Gladstein, 1984; Rubin, Plovnick, & Fry, 1975).

Team interaction is enhanced when each member contributes their technical/professional abilities to accomplishment of the team's objectives (Hollenbeck, Ilgen, Sego, Hedlund, Major, & Phillips, 1995; Hutchins, 1990). This dimension consists of abilities that are specific to the core technical aspects of the role of each healthcare profession. For example, knowledge of geriatric principles must be coupled with technical abilities to develop effective interdisciplinary patient care plans. Additionally,

team members need to be familiar with the role of other professions in order to best coordinate their actions with other members of the team.

Communication is about sharing enough meaning that group members can coordinate their efforts to complete the group's interdependent tasks. The effectiveness of small groups is very much dependent on each member's communication skills. Communication skills are believed to be an important individual-level competency because during group interactions, members are always communicating either verbal or nonverbal signs to each other, which receivers pick up, interpret, and respond to (Adams & Galanes, 2000; Cragan & Wright, 1999). Thus, communication is the vehicle that the team uses to accomplish much of its mission through the exchange of information. All interaction involves some form of communication. It is through communication that members of the team get and give feedback, address clinical issues, collaborate, coordinate, problem solve, resolve conflict, and make decisions.

An important principle of Interdisciplinary Healthcare Teams is that leadership is shared among team members and is not necessarily related to a single designated member with formal authority over the team (Drinka & Clark, 2000). This principle is most often expressed as responsibility for team performance "...rests with every team member and cannot be delegated to a team leader or any single individual on the team" (Siegler, et al., 1998, p. 14). The principle of sharing leadership is sometimes referred to as distributed leadership (Spillane, 2005). Leadership can be thought of as providing structure, direction and support to team members and may include such functions as conveying information, seeking input from team members, offering solutions to resolve

disagreement among team members, drawing out members, and effectively intervening to improve team functioning. As defined by Cragan and Wright (1999), small group leadership is "...communication that positively influences the group to move in the direction of the group's goals" (p. 184). This definition implies that leadership occurs through the process of communication and can be performed by a designated leader or by any group member.

Table 1 presents the 17 TSS items and associates each item with either leadership communication skills or technical/professional abilities as identified in this study's conceptual framework. The Table shows that ten of the 17 TSS items are believed to be associated with the leadership communication factor; the other seven items are associated with the technical/professional abilities factor. For example, "Handle disagreements effectively" is identified as belonging to the leadership communications factors. This TSS item addresses shared leadership in that any well trained team member can perform this skill at any point during the team's interaction process. This TSS item also addresses purpose driven communication. Rarely do individuals write, speak, listen or send nonverbal signals without having a purpose. Communication is the vehicle that the team uses to accomplish much of its mission. A good example of technical/professional abilities is "Apply your knowledge of geriatric principles for the care of older persons in a team care setting."

Research Hypotheses

A benefit of having a conceptual model is that hypotheses can be deduced and tested. Accordingly, this investigation of the factorial validity of the TSS, based on the

Table 1

Team Skills Scale Items and Associated Dimensions from the Conceptual Model of Individual-Level Team Competencies

Team Skills Scale Item	Model of I-LTC Dimension
1. Function effectively in an interdisciplinary team	Leadership Communication Skills
2. Treat geriatric team members as colleagues	Leadership Communication Skills
3. Identify contributions to patient care that different disciplines can offer	Technical/Professional Abilities
4. Apply your knowledge of geriatric principles for the care of older persons in a team care setting	Technical/Professional Abilities
5. Ensure that patient/family preferences/goals are considered when developing the team's care plan	Technical/Professional Abilities
6. Handle disagreements effectively	Leadership Communication Skills
7. Strengthen cooperation among disciplines	Leadership Communication Skills
8. Carry out responsibilities specific to your discipline's role on a team	Technical/Professional Abilities
9. Address clinical issues succinctly in interdisciplinary meetings	Leadership Communication Skills
10. Participate actively at team meetings	Leadership Communication Skills
11. Develop an interdisciplinary care plan	Technical/Professional Abilities
12. Adjust your care to support the team goals	Technical/Professional Abilities
13. Develop intervention strategies that help patients attain goals	Technical/Professional Abilities
14. Raise appropriate issues at team meetings	Leadership Communication Skills
15. Recognize when the team is not functioning well	Leadership Communication Skills
16. Intervene effectively to improve team functioning	Leadership Communication Skills
17. Help draw out team members who are not participating actively in meetings	Leadership Communication Skills

author's theorizing about individual-level team competencies, will be guided by the following hypotheses:

Hypothesis 1: The Team Skills Scale (TSS) is a first-order two-factor structure (leadership communication skills and technical/professional abilities).

Hypothesis 2: Performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples.

Hypothesis 3: Student trainee age, attitude about the physician as team leader and sole patient care decision-maker, and attitude about the quality of patient care that is delivered by teams are predictors of self-perceived team skills as measured by the plausible TSS measurement model.

After performing confirmatory factor analysis and revising, if needed, the plausible TSS model will be used to evaluate model invariance; specifically, does the model replicate (Hypothesis 2). If the model performs equivalently, then there is more evidence to support the plausibility of the measurement model.

Data and Analysis

TSS structure was evaluated based on this author's conceptualization of individual-level competencies required for effective team interaction. The TSS purportedly provides information about the individual's self-perceived team skills. The TSS can be thought of in terms of skills that individuals bring to the team process; in turn, these individual-level skills contribute to team interaction and ultimately, team effectiveness.

The New York University Geriatric Interdisciplinary Team Training (GITT) Resource Center provided the data for this study. The data were collected between 1997 and 1999 and included the data for the eight GITT projects funded by The John A. Hartford Foundation (N = 1,715). Data were collected from student trainees, preceptor trainees, and preceptors who were not trainees. For purposes of this study, only student trainee data were used.

This nonexperimental study used secondary data that was collected for the GITT program evaluation to assess the factorial validity of the TSS. Factorial validity is a form of construct validity that examines the factor structure of an instrument and answers the question: "Is the factor structure valid?" (Tabachnick & Fidell, 1996).

Confirmatory factor analysis (CFA) comprised of two first-order factors, leadership communication skills and technical/professional, abilities will be performed to estimate how well the observed variables represent the two first-order factors. The goals were to: 1) assess the scale's factorial validity and revise the scale, if needed; 2) evaluate the factorial invariance of the plausible structure of the TSS; and 3) evaluate a covariance structure model of the TSS.

SPSS (version 13.1) statistical software was used to screen the data, assess reliability, and to produce descriptive statistics about the sample. Analysis of Moment Structures (Amos) 4.0 was used to perform CFA and to evaluate the structural model.

Significance

As part of the reforms in the ways that health related professionals are educated and trained for the 21st Century workplace, there is a critical need for approaches to

measure and assess the acquisition of interdisciplinary team skills. Observational methods tend to be used most often for evaluating team training; however, this assessment method is labor and time intensive. A psychometrically sound self-report paper-and-pencil questionnaire that measures a trainee self-efficacy in terms of team competencies would be a valuable contribution because self-efficacy measures are not subject to the primary criticisms associated with paper-and-pencil tests that purport to measure skill mastery. The first criticism is that the only feasible way to measure skill -- team or otherwise -- is through observation of individuals as they perform tasks that require using a given skill set. This criticism is particularly true in healthcare settings where experiential learning and clinical rotations serve as the vehicle for skills acquisition and demonstration of abilities. The other criticism is that a paper-and-pencil test is more likely to measure knowledge rather than skills. A paper-and-pencil measure of team skills self-efficacy is not subject to this criticism because it measures trainee task specific self-perception of what she/he can do. Self-efficacy has been shown to be a strong predictor of what an individual can do as well as a predictor of future behavior (Pajares, 2003).

This study also makes a contribution to the literature by proposing a conceptual model of individual-level team competencies (I-LTC). A literature search found no existing models of individual-level team competencies. A validated conceptual model of individual-level team competencies could be useful beyond the current study in furthering an evidence base that may eventually provide insights about curricula that best equip students with the knowledge, skills, abilities, and attitudes they will need for

effective interactions with other team members. The competencies also can guide effective instruction and assessment. A validated Model of I-LTC could be used to investigate the impact of training on skills acquisition and the likelihood of transfer of training to practice settings. The model could also serve as a springboard for further work in operationally defining variables or describing skills.

Limitations of the Study

Despite the potential contributions of this research to both theory and practice, there are a number of factors mitigating utility of study results. The Model of I-LTC has no direct empirical history nor is validation of the model the focus of the current study. However, the lack of prior empirical evidence to support the model could result in undetectable misclassification of some of the TSS items. Additionally, the Scale was developed 'atheoretically' which indicates that there is the possibility that some important teamwork skills are not operationalized and measured by the TSS. Together these two limitations leave much room for unexpected findings and post hoc rationalization not supported by the Model of I-LTC. Nonetheless, the present study adds to the efforts of other researchers in charting the terrain of teamwork as an individual skill for interdisciplinary healthcare professions in general and more specifically for professionals involved in geriatric healthcare.

Another limitation is related to the wording of TSS items. Bandura (2001) recommends that each item on a self-efficacy scale be phrased to capture what the individual perceives she/he "can do" at the time the TSS is administered because "can" represents judgment of capability. Each TSS item should lead with the following

wording "How well can you …". As an example, the best wording for item 17 would have been "How well can you help draw out team members who are not participating actively in meetings?" compared to the actual wording of this item which reads "Help draw out team members who are not participating actively in meetings" However, this potential problem may be mitigated because the TSS starts with a global statement asking participants to: "Please rate your ability to carry out each of the following tasks at this point in your training using a five-point scale" (Siegler, et al., 1998, p. 264).

Finally, non-experimental single group pre/post test design is a conventional method of measuring change as a result of an educational intervention. In this design, an instrument is administered just before the intervention and again following the intervention. The differences between the scores obtained from the two administrations of the instrument are computed and the impact of the educational intervention is inferred from the difference score (Trochim, 2001). The strength of the research design greatly influences the knowledge claims that can be made. However, Cook and Campbell (1979) noted sources of invalidity that call into question the utility of using the pretest /posttest design to determine the effectiveness of an educational intervention. Campbell and Stanley (1963) used the term "sources of invalidity" in their presentation of methodological recommendations for research on teaching. The term in current use is "threats to internal validity." Among the validity threats inherent in this design are two that threaten construct validity: interaction between testing and treatment and interaction between multiple treatments (Trochim, 2001).

Interaction between testing and treatment occurs when the pretest sensitizes participants to what the intervention will be and, in doing so, participants may become more receptive to the intervention. Thus, the pretest becomes part of the intervention (Campbell & Stanley, 1963; Cook & Campbell, 1979: Trochim, 2001). Specifically, interaction between testing and treatment may have occurred because GITT participants were aware from the onset of training of what the program's goals and objectives were and may have been predisposed to facilitating the program's intent.

Another threat to construct validity inherent in the use of the pretest/posttest design is interaction between multiple treatments. GITT participants were involved in a number of program activities (treatments); therefore, it is not likely that the specific intervention activity/activities responsible for the observed change in self-efficacy can be determined.

Program evaluation designs that include the use of control groups offer the best potential to minimize the three sources of invalidity discussed above (Trochim, 2001). However, assessing change in self-efficacy using the pretest/posttest design is widely used and accepted to the extent that the instrument's psychometric properties are known.

Organization of the Study

Chapter 1 presented an introduction to the problem and defined several key terms as they are used throughout this study. The remainder of this study moves from the literature review to methods, results, and conclusions. The literature review in Chapter 2 summarizes and critiques relevant literature to identify competencies that individuals must possess to be effective members of teams and develops an individual-level team

competency conceptual model. Then, the TSS factor structure will be specified in context to the proposed conceptual model.

Chapter 3 describes the data used in the study and provides a discussion of the statistical methods that will be used to address the study's hypotheses. Study results are presented in Chapter 4. Finally, Chapter 5 contains a discussion of the findings, implications, theoretical considerations, limitations of the study, and suggestions for future research.

CHAPTER 2: LITERATURE REVIEW

The purpose of this study was to assess the factorial validity of the Team Skills Scale (TSS). Analysis of the Scale's factorial validity was evaluated in context with the author's theorizing about individual-level competencies as derived from a review of the literature.

The literature review is composed of five major sections. First, evidence of the effectiveness of geriatric interdisciplinary teams is presented. Next, the Geriatric Interdisciplinary Team Training (GITT) Program is summarized and is followed by a discussion of group theories and conceptual models that include a component related to individual-level team competencies. Then, the author's proposed conceptual model of individual-level team competencies is described. Finally, the TSS measurement model is proposed and study hypotheses deduced from the proposed conceptual model are presented.

Effectiveness of Geriatric Interdisciplinary Teams

There is some empirical evidence supporting the effectiveness of interdisciplinary team approaches in the delivery of care to older persons with complex problems. Stuck, Siu, Wieland, and Rubenstein (1993) reviewed 28 research studies from the medical literature that examined the effectiveness of interdisciplinary team approaches. Meta analysis applied to these studies showed that geriatric patients who received care using

interdisciplinary team approaches had increased survival, improved physical function and increased likelihood of living at home.

Also, several randomized clinical trials have demonstrated that patients who receive care based on interdisciplinary team models had significantly greater improvement in health perception, smaller increases in numbers of clinic visits and instrumental activities of daily living (IADL) impairments, improved social activity, greater improvement in depression scores, general well-being, life satisfaction, and Mini-Mental State Exam scores compared to patients who received usual care (Burns, Nichols, Martindale-Adams, & Graney, 2000; Rubin,1993). Usual care is generally understood to be the traditional medical model's multidisciplinary process focused on resolving the acute care issues for the presenting medical problem(s).

In most of the studies presented in the literature, the interdisciplinary team model was limited to comprehensive geriatric assessment (CGA) rather than comprehensive geriatric evaluation and management (GEM). The primary difference between CGA and GEM is that CGA is limited to assessing problems and making recommendations while GEM goes beyond assessment and recommendations to include treatment and case management (Urdangarin, 2000).

> While it is appropriate that patient outcomes have been the focus of empirical studies, little attention has been paid to the nature of the team itself. It is conceivable that factors such as individual-level team competencies and the team's interaction process impacts patient outcomes (team effectiveness). Recognizing that team effectiveness is influenced by

> the team skills that each healthcare provider brings to the process, the Geriatric Interdisciplinary Team Training (GITT) program was created to among other things "...Create a cadre of well-trained professionals competent in gerontology and interdisciplinary team skills..., and ...Test models of staff development training for practicing health professionals..." (Siegler, 1998, p. 5).

The GITT Program

The Geriatric Interdisciplinary Team Training (GITT) program was a three-year (1997-2000) national initiative supported by The John A. Hartford Foundation. The Foundation sought to develop and test prototypes of geriatric team training (Hyer, 1998). Nine projects were funded to implement the training models that they had developed during the 1995-1996 planning year. After implementation, two of the programs merged and at the end of the GITT program eight training models were made available for national dissemination.

Hyer (1998) describes how project sites were selected from the more than thirty programs that applied for GITT grants noting that six of the eight projects involved Geriatric Education Centers (GEC). Since 1985, GECs have been leaders in providing interdisciplinary geriatric educational opportunities and in developing and disseminating curricula to health professionals and academic medical centers. Existing GEC partnerships provided a solid foundation for GITT start-up and implementation.

Each of the eight projects developed and implemented its own didactic and practicum team-training model based on the special needs and capacities of the individual

institutions. As examples, one program conducted "virtual" team meetings using distance learning technologies and another program was tailored for a managed care setting. Additionally, there were variations in trainee disciplines, duration of training and the number and nature of collaborating partners.

GITT Models

While all eight GITT programs consisted of both didactic and clinical teaching approaches and used the same core program evaluation measures, the design and implementation of the programs varied. According to The GITT Implementation Manual (2001), among the eight sites there were three general models of teaching geriatric interdisciplinary team care: Academic Model, Clinical Model, and Mixed model.

The Academic Model was used by Houston GITT, the Minnesota GITT, and the University of South Florida. In this model, geriatric teaming courses were taught for credit within a university system by faculty from schools of medicine, nursing, social work, and other targeted disciplines. On Lok GITT and the Great Lakes GITT used the Clinical Model, where geriatric team training was presented in clinical settings. Students were recruited from current healthcare practitioners such as nurses, physicians, social workers. The GITT Implementation Manual (2001) noted that "This model works especially well if there is a Geriatric Education Center (GEC) partnership" (Chapter 6, p. 3). The eight project sites and the respective training model are summarized in Table 2.

The Mixed Model was used by GITT programs at Mount Sinai, the University of Colorado Health Sciences Center, and the Rush Presbyterian – St. Luke's Medical Center. This model was a combination of aspects of the two previously described

Table 2

Geriatric Interdisciplinary Team Training (GITT) Program Site Descriptions

GITT Sites	Trainees	Program Features
Great Lakes GITT	internal medicine, family medicine, and psychiatry residents; physician assistant students; advanced practice nursing students; graduate level social work pharmacy and psychology students	Clinical Model; Partnerships: two hospital systems, six academic partners, a GEC, and 22 clinical training sites; didactic instruction through required and elective courses, conferences, workshops, and text and computer-based resources
Houston GITT	medical and psychiatry residents; physician assistant students; advanced practice nurses; graduate level social work, pharmacy, and psychology students	Academic Model; Partnerships: seven educational programs and six primary care facilities; case examples and standardized patient scripts; exercises and activities for groups and self-instruction; each topic area to be a "stand alone" teaching topic in either didactic or clinical settings
Mount Sinai Medical Center GITT	medical house staff; advanced practice nursing students; graduate level social work students	Mixed Model; Partnerships: three clinical sites and four educational partners; primary program focus teach how an interdisciplinary healthcare team organizes itself to deliver quality care in a managed care setting
On Lok, Inc. GITT	internal medicine residents; nurse practitioner students; graduate level social work, physical and occupational therapy students	Clinical Model; Partnerships: four academic partners and six clinical partners; primary objective was to provide high quality and effective interdisciplinary care to older, chronically ill persons

Table 2 (Continued).

Geriatric Interdisciplinary Team Training (GITT) Program Site Descriptions

GITT Sites	Trainees	Program Features
Rush Presbyterian – St. Luke's Medical Center GITT	Internal and family medicine residents; graduate level nursing, social work, occupational therapy, pharmacy, speech language pathology, audiology, clinical nutrition, ethics, pastoral counseling, and health systems management students	Mixed Model; Partnerships: four academic partners; use of virtual meetings to overcome logistical obstacles of having clinicians meet in person to discuss patient cases
University of Colorado Health Sciences Center GITT	Internal medicine and family practice residents; medical students, doctorate pharmacy students; dental students; nurse practitioner students; graduate level social work and law students	Mixed Model; Partnerships: two universities and five clinical agencies; these agencies represented Medicare traditional fee-for-service, capitated Medicare ambulatory setting, and a capitated community-based long-term care setting (PACE)
University of Minnesota GITT	Medial residents; graduate level nursing, pharmacy and social work students	Academic Model; Partnerships: four academic departments, a GEC, and four community-based clinical sites; The program was sensitive to the growing pressure for more cost-effective care and taught teamwork through a model that stresses productivity; social work students were paid a stipend for participation in the program

Table 2 (Continued).

Geriatric Interdisciplinary Team Training (GITT) Program Site Descriptions

GITT Sites	Trainees	Program Features
University of South Florida GITT	Family practice residents, graduate level nursing, social work, public health and pastoral counseling students	Academic Model; Partnerships: six academic programs and four community-based clinical sites: an interdisciplinary clinic in a senior housing complex that serves minority and low-income elderly; Hospice of the Florida Suncoast; a Medicare Risk HMO emphasizing preventive health, patient education, and mental health services; The Memory Improvement Clinic that provides diagnostic and ongoing medical and psychosocial management of patients with Alzheimer's disease

Note. Information contained in Table 2 was summarized based on program descriptions from the eight GITT websites and from Chapter 6 of the GITT Implementation Manual.

models. According to the GITT Implementation Manual (2001), "This model might emerge when faculty with joint appointments blend the two roles of educator/clinician in order to teach GITT. Credits may or may not be awarded, depending on the goals of the leaders and learners" (Chapter 6, p. 3).

GITT Core Didactic Curriculum

The GITT Core didactic curriculum provided a common foundation for the eight project sites and was designed so that trainees experienced both didactic and clinical practica.

Table 3 presents the six training topics and the associated objectives. According to the *GITT Implementation Manual (2001)*, "The didactic curriculum is the cornerstone of GITT and is a composite of essential topics that experts agree must be mastered before effective interdisciplinary team training for the elderly can take place" (p. 8).

There were six core topic areas and Topic 1 was entitled Teams and Team Work. This topic area provided a foundation in the essentials of team collaboration and team development. Topic 2 was entitled Team Member Roles and Responsibilities and provided an awareness of the technical skills of various team members and the fundamentals of team leadership. Topics 3 through 6 addressed team communication and conflict resolution, multiculturalism GITT care planning process, , and ethics within teams.

Teamwork Theories and Models

Most small group theories focus exclusively on the group as the unit of analysis; the role of individual-level competencies has received little attention. In fact, even the few theories that included individual-level competencies as a construct have not delineated the knowledge, skills, abilities, and attitudes necessary for effective team interaction. This omission, to some extent, reflects the complexity of the team literature A review of the literatures across research areas as diverse as healthcare, human resource management, social psychology, and military science produced only a few models that addressed individual-level competencies. The summary of these theories is organized into six subheading focused on group development, leadership, team performance/effectiveness, , teamwork skills/member characteristics, and systems models

Table 3

GITT Core Didactic Curriculum Topics and Objectives

Topic	Objectives
Teams and Teamwork	Understand the need for and importance of collaboration and interdisciplinary teams
	Understand the different types of teams
	Understand and recognize the phases of team development
	Understand the need for team rules and what they mean
	Recognize components of successful teamwork
Team Member Roles and Responsibilities	Develop an awareness of team member role differentiation
	Recognize leadership potential and roles
	Understand the principles of successful teamwork
Team Communication and Conflict Resolution	Recognize barriers that affect communication exchange among providers, patients, their families and communities
	Recognize some effective communication tools and techniques that will contribute to good team function
	Identify how diverse styles of communication contribute to team function
	Recognize sources and types of conflict in teamwork
	Recognize sources and types of conflict in teamwork
	Identify strategies for managing conflict in an interdisciplinary team
Multiculturalism	Understand the necessity of developing cultural competency
	Identify some requirements of cultural competency in interactions

Table 3 (continued).

GITT Core Didactic Curriculum Topics and Objectives

Topic	Objectives
GITT Care Planning Process	Understand how treatment goals are determined within an interdisciplinary team and identify methods that maximize outcomes
	Assess functional status in older adults
	Assess cognitive status in older adults
	Describe the functional (social, physical, emotional and intellectual) dimensions and interpretations of quality of life
	Recognize the importance of value maps and quality of life
	Describe the relationship between interprofessional communication and quality of life
	Describe the perceptual dimensions and interpretations of quality of life
	Identify the mechanism to evaluate quality of life utilizing valid and reliable measures
Ethics within Teams	Define the terms ethics, ethical dilemma, bioethics, clinical ethics, medical ethics, and nursing ethics
	Describe the major considerations that should be considered in analysis of ethical dilemmas in health care
	Apply legal and ethical principles in the analysis of complex issues related to care of the elderly, such as informed consent, and refusal of treatment, advance directives, Patient Self-Determination Act, and just allocation of resources
	Apply the concept of decision-specific capacity to older people
	Discuss the difference between personal values, professional values, and professional codes of ethics
	Apply a decision-making model to an ethical dilemma in clinical practice

Group Development Theories

A number of researchers have theorized about how groups grow and change through time with the intent of identifying whether there are patterns associated with how the group achieves it goals. Generally, group development theories describe the issues that are said to confront all groups and they describe the order in which these issues are believed to occur. Tuckman's (1965) classic description of group development is one of the earliest of these theories. Based on his synthesis of the group development literature, Tuckman argued that groups go through four distinct stages (Forming, Storming, Norming, and Performing) as they come to together and begin interacting. In 1977, Tuckman and Jensen added a fifth stage to the model, Adjourning. Subsequent empirical evidence generally supports the conclusion that groups move through a series of phases or stages during its life cycle until the group achieves proficiency, completes its objectives, and then adjourns (Bennis & Shepard, 1956; Bion, 1961; Gersick, 1988; Mann, Gibbard, & Hartman, 1967; Tuckman & Jensen, 1977).

Tuckman's theory can be applied to either the individual level of analysis or the group-level of analysis. As applied to the individual level of analysis, the Forming stage can be described as the "getting to know you stage". In this stage, individuals are not clear about their contribution and tend to be concerned with the question "How do I fit in?" (Bion, 1961; Slater, 1966). The Storming stage is characterized by a range of conflict as individual personalities are revealed and team members challenge one another. The quality of team interaction is established during this stage as members experience the give and take of resolving conflicts and establish individual roles within the group (Mills,

1964; Slater, 1966). Individuals know what their responsibilities and roles are once the group reaches the Norming stage which is characterized by cooperation and collaboration (Mills, 1964; Wheelan, 1990). When reached, productivity is the hallmark of the fourth stage, Performing. In this stage, team members are both highly task oriented and highly people oriented. Individuals are concerned with how best they can perform their role (Bennis & Shepard, 1956; Bion, 1961; Slater, 1966; Tuckman, 1965).

Adjourning is about completion of the group's mission and group members disengage from each other. Individuals are likely to be proud of the group's achievements. Healthcare teams are less likely to adjourn as a unit. It is more likely that some individuals will enter and leave the group as their input is needed or as job assignments change. This may require that the group develop rituals to help individuals recognize their contributions to the group and consciously move on as they exit the group.

Tuckman's theory is not without its critics. Forsyth (1990) argued that groups are dynamic systems and change occurs continually. Forsyth further argued that there is some overlap between the different stages in Tuckman's model. For example, "when group conflict is waning... feelings of cohesion may be increasing, but these time-dependent changes do not occur in a discontinuous, step like sequence" (p. 89). Using a similar argument, Smith (2005) described human processes as frequently characterized by variability and flux; thus, a linear model may likely be a poor representation of how groups develop. These criticisms may be a misinterpretation of Tuckman's original work which described his observations of how groups evolve over time. Nothing in

Tuckman's observations precluded the possibility that groups can transition through the various stages in a non-linear matter. As an example, a group might be happily Norming or Performing, but a new member might force them back into Storming. Thus, transformative forces can spiral the group from any one stage into any of the other stages. However, according to Tuckman, it is unlikely that the group will be in more than one stage at any moment in time.

Other Tuckman critics have noted that a team can work its way through the developmental stages of Forming, Storming, Norming and Performing, yet never challenge dysfunctional assumptions (Milanovich, Salas, Cannon-Bowers, & Muniz, 2000). Despite criticisms about the model, there is value in having criteria for identifying where a group is in its developmental process. The stages of group development provide a means to measure a group's maturity and recognize that there is no set amount of time that it takes for a group to become mature. Information about the group's developmental stage can be used to help the group understand interaction issues and help it progress to having well-functioning working relationships (Performing stage).

Gersick's (1988, 1989) Time and Transition Model of group development was formulated based on observations of eight different types of teams. The Model proposes that teamwork is characterized by punctuated equilibrium in which the team alternates between inertia and radical change. Gersick (1988) noted that all eight types of teams developed and agreed to a plan of action for task accomplishment (inertia phase). Then, halfway towards task completion, the team would abandoned their original plan and develop a new plan of action (radical change). Sundstrom, DeMeuse, and Futrell (1990)

noted that the model may best be applied to the development of teams charged with innovation projects; as examples, the development of the atom bomb, the early days of space travel, or genetic engineering.

Salas, Dickinson, Converse, and Tannenbaum (1992) believe that the Time and Transition Model highlights the dynamic character of team performance and suggests team decisions related to planning and task performance can be predicted. However, there is almost no empirical evidence supporting this model beyond Gersick's original studies.

The Team Evolution and Maturation (TEAM) model describes how task-oriented teams move through a combination of Tuckman's (1965) stages of group development and Gersick's (1988) punctuated equilibrium, before, during, and after task performance. The model posits that there are two categories of skills that can be distinguished and developed over the team's life cycle: taskwork skills and teamwork skills. Taskwork skills involve behaviors that are related to tasks performed by individual team members. Teamwork skills are related to team member interactions. Empirical evidence suggests that the Model accurately describes the development of Naval flight teams. However, the TEAM model has not been tested with non-military teams (Morgan, Glickman, Woodard, Blaiwes, Salas, 1986; Morgan, Salas, & Glickman, 1994).

As groups evolve, they spiral through the same developmental issues and group development theories provide a framework for understanding those issues and for identifying appropriate interventions. For example, whenever there is a change in group membership the group again must deal with issues of inclusion and role definition. Thus,

group development theories offer a tool for understanding and for intervening effectively in the group process and interaction.

Leadership Theories

According to Hackman (1992) team leadership is concerned with those "activities that contribute to the establishment and maintenance of favorable performance conditions" (p. 120). In a similar vein, Cragan and Wright (1999) define small group leadership as "...communication that positively influences the group to move in the direction of the group's goals" (p. 165). In both cases emphasis is on motivating others to achieve the group's performance objectives.

Cragan and Wright (1999) described three general classes of communication behavior that represent leadership of a discussion and suggest that these behaviors can be performed by a designated group leader or any member of the group. First, task behaviors are necessary in order to generate and evaluate ideas and include contributing, seeking and evaluating ideas. While task behaviors are generally readily performed by group members, the second class of communication behaviors, procedural behaviors, require knowledge of group process. Procedural behaviors include goal setting, agenda making, clarifying, summarizing, verbalizing consensus, establishing work patterns and establishing protocols. The third class of communication behaviors, interpersonal behaviors, includes maintaining mutual respect, maintaining a positive group atmosphere and group self-analysis. While the nomenclature differs, the communication behaviors are consistent with the team interaction model developed by Bales in the 1950s.

Bales' Interaction Process Analysis (IPA) model (1950, 1999) was among the earliest studies of small group leadership. Using the IPA model he studied methods for measuring leadership in face-to-face small groups. Bales found empirical support for the conclusion that individuals provide input into groups through two broad categories of observable leadership behaviors: instrumental leadership and socio-emotional leadership. Instrumental leadership is concerned with task oriented behaviors and is expressed in terms of asking questions, summarizing discussions and giving directions for task completion. Socio-emotional leadership is concerned with and is often expressed by providing feedback to the group or individual group members.

Curran and Takata (2001) discussed the two categories of observable leadership as conceived in Bales' (1950, 1999) IPA model and noted that leadership behaviors are likely to move along a positive/negative continuum. The first leadership category, instrumental leadership, includes two subcategories of observable behaviors: 1) giving information, specifically: explaining, summarizing and making suggestions and 2) asking questions, specifically: asking for details, asking for clarification and posing hypothetical questions. For example, in the process of developing and implementing a patient care plan, the leader who is task-oriented may operate predominately as an instrumental leader. This type of leader may be less concerned with the tone of feedback to the group than she is with concern for getting the patient care plan done and may chastise members who are slow in providing input during the care planning process.

The second leadership category, socio-emotional leadership, also includes two subcategories: 1) positive reinforcement and 2) negative behaviors. Examples of positive

reinforcement behaviors may include acknowledgement of good ideas and team member concerns, interventions to clarify disagreements in a way that reinforces a positive atmosphere, and informal and formal recognition of group member contribution. Negative leader behaviors may include chastising violations of rules of respect, defining or limiting group or individual behaviors, or defining standards for group tolerance of differences between team members. Curran and Takata (2001) posit that a leader who creates balance between instrumental and socio-emotional leadership behaviors is likely to be more effective than leader who operates predominately from either one of the behavioral categories.

One of the significant implications of Bales' work is that focusing on instrumental functions alone is not sufficient for maintaining high functioning groups. Rather, group members must exhibit behaviors that satisfy the emotional needs of group members, such as providing recognition for individual contributions to the team. Another implication that is central to the current study is that the communication process is the primary conduit to accomplishing both instrumental and socio-emotional leadership functions and that those functions are not limited to a single group member. Rather, leadership functions occur as a nature consequence of group interaction and can be performed by any member of the group because any team member can take on the leader role based on the context of each situation and the type of knowledge and technical expertise required to address specific issues or tasks.

Team Performance Theories

Generally, the primary team objective is performance. Performance is about

completing tasks and accomplishing team goals and objectives (Katzenbach & Smith, 1999). Performance may also be expressed in terms of effectiveness. Specifically, what were the patient outcomes? Although most team performance theories were not developed to depict the relationship between individual-level competencies and team performance, some do depict team member attributes and team performance as one of a number of factors affecting team performance.

Based on their review of the team performance literature, Nieva, Fleishman, and Reick (1978) proposed a team performance model that includes individual-level competencies as a model component. Nieva at al. (1978) theorized that team performance is dependent on two categories of task behaviors: individual tasks and coordinated tasks. Individual task behaviors refer to discrete tasks that do not require coordination. Coordinated task behaviors refer to tasks and subtasks that require interaction and coordination among team members. Further, task behaviors are mediated by three factors: 1) member resources such as, knowledge, skills, abilities, and other individual attributes; 2) team characteristics such as team size and cohesion; and 3) task characteristics and demands. The model proposes that member resources influence team interaction and that team performance directly or indirectly affects the quality of team interaction.

The Nieva et al. (1978) model was developed as part of a government contract to the study military combat teams and has not been empirically evaluated beyond its original purpose. However, the model is important because it emphasizes the multidimensional aspect of the team performance and specifically recognized individual

KSAs as an integral part of team interaction and performance. Also, the model incorporates and further validates Bales' (1950) evidence that individuals provide input into groups through instrumental and socio-emotional functions.

Hackman's (1983) model of work team effectiveness emphasizes the effect of the organizational context in defining the boundaries of the team's process, interaction and performance. His model explicitly accounts for the effects of the organization's environment on team member interaction as well as the effects of team structure on team interaction. The external environment refers to the organizational and patient specific setting for which the team operates. This includes organizational structure, social systems and norms, and patient specific factors that affect the operation of the team and its members. It is now well recognized that one of the most important factors affecting the survival of interdisciplinary healthcare teams (IHCT) is organizational support for the team's work (Drinka & Clark, 2000).

Hackman's (1983) model is prescriptive in that the focus is on how to create the necessary conditions for better team interaction and ultimately, better team effectiveness. He proposed that team training is one of the keys to creating better team interaction and effectiveness. Although the idea of team trainings seems self evident in today's team-centered organizations, when originally proposed by Hackman formal training for teams was the exception rather than the norm.

One of the few models that has a large body of empirical support is Gladstein's (1984) model of group process and group effectiveness. The model proposes that group effectiveness is a function of group communication moderated by task demands and the

group's external environment. As defined by the model, task demand is a function of task complexity, environmental uncertainty, and the level of team interdependence. Extending Hackman's (1983) conceptualization of the external environment, Gladstein (1984) indicated that the best way to assess organizational support for the group is to measure factors such as the organizational role of each member in the group and the resources made available to the group. Groups composed of members who have well respected roles within the organization and that have sufficient resources to support its functions are far more likely to be operating in a supportive organizational climate. Gladstein's model is significant because it highlights the influence of the organizational context on group effectiveness. The model also indicates that organizational support influences group interaction.

Heinemann and Zeiss (2002) developed a conceptual model that specifies factors believed to influence geriatric interdisciplinary healthcare team performance. The model is organized in a three-tiered hierarchal scheme: domains, dimensions and elements. The four domains are: structure, context, process, and productivity. Each domain includes two dimensions and each dimension includes a number of elements that can be operationalized to measure aspects of the respective dimension. While the overall model is focused on team performance as the unit of analysis, some model elements are focused on the individual as the unit of analysis. For example, at least five of the 15 elements that can be used operationalize the team dimension of the context domain identify the individual as the unit of analysis. The measures are: "attitudes toward teams and teamwork" "being oneself and getting to know others" "satisfaction with colleagues,

team and teamwork", "feeling pressure and stress", and "work viewed as interesting, challenging and important." The model implies that even when the team is the basic unit of interest, analysis of individual-level measures remains central to assessing team interaction.

Team Teamwork Skills/ Member Characteristics

Stevens and Campion (1994) synthesized the social psychology literature and chose 14 characteristics that they believed could be used to select individuals who show high potential for teamwork within organizational settings. The characteristics were grouped into two major categories: (1) Interpersonal skills and (2) self-management KSAs. Interpersonal KSAs included ten competencies that were grouped into operationalized three constructs: conflict resolution, collaborative problem solving, and communication. The other major category, self-management KSAa, was defined as the team's basic managerial and supervisory functions (process factors). These process factors were operationalized as: goal setting, planning, task coordination and performance management. Stevens and Campion's (1994) theoretical arguments were not adopted as the framework for the current study because the model is too restrictive. The Stevens and Campion's (1994) model focuses exclusively on the skills component of KSA and is silent on the knowledge and abilities components of KSA. Additionally, there may be competencies that are unique to healthcare settings, such as clinical ethics, not captured in Stevens and Campion's model.

Subsequent to proposing their theorizing about team skills, Stevens and Campion (1999) used the 14 KSAs to develop the *Teamwork-KSA Test.* Validation studies of the

instrument identified two second-order factors (self-management and interpersonal KSAs) and five first-order factors. Inter-rater reliability was used to establish instrument content validity for the five first-order factors. The instrument's construct validity was established by comparing the *Teamwork-KSA Test* scores to a number of employment aptitude instruments, which were designed to measure the same set of KSAs. The final instrument contains 35 multiple-choice questions purported to assess conflict resolution, collaborative problem-solving, communication, and goal setting and performance management. The instrument was reported by the authors to be highly correlated with traditional cognitive tests (ranging from .91 to .99) which suggest that it may be measuring general cognitive ability/intelligence rather than what individuals can actually do. Albeit, there is high correlations between job knowledge tests and job performance (Schmidt & Hunter, 1998); it is conceivable that not all individuals who are knowledgeable about teamwork skills have the ability to implement what they know.

Hollenbeck's multi-level theory indicates that three key individual differences are predictive of an individual's style of team interaction. First, individuals must be able to collect large amounts of accurate information regarding issues that require team decision-making. Second, the degree to which each individual can take information and translate it into recommendations is also predictive of an individual's interaction style. Finally, the individual's capacity to form effective relationships with other team members is essential to effective integration of the information that the team considers while engaged in problem-solving and decision-making interactions (Hollenbeck, Ilgen, Sego, et al., 1995; Hollenbeck, LePine, & Ilgen, 1996). The authors suggest that cognitive ability

variables will drive the acquisition of skills (the first two individual differences) while personality variables will drive the capacity to form effective relationships. This theory suggests that cognitive ability is more critical for the performance of task behaviors; whereas, personality variables (agreeableness, extroversion and conscientiousness) are important for interpersonal behaviors (Hogan, Hogan, & Roberts, 1996). However, effective team interaction requires balance between cognitive ability an personality variables. For example, the team may fail to benefit from the insights of an introverted but highly task competent member in situations where a highly extroverted, but potentially less capable, member steers the direction of decision-making processes without gaining the insights of task competent but less interpersonally dominant members.

Salas, Burke, and Stagl (2004) summarized the team effectiveness literature. Key findings included: 1) there are at least two team performance components (teamwork and taskwork); 2) contextual factors (team mission and operating environment) influence the importance of various competencies and posited; 3) teams develop and transform over time; and 4) there are many generic teamwork skills. Based on their findings, Salas, and colleagues (2004) posited 15 principles that they believe constitute effective teamwork; irrespective of the team's contextual environment. Some TSS items reflect these principles. For example, TSS item VTSS16, "Intervene effectively to improve team functioning", may operationalize the team effectiveness principle about team members monitoring each other's behavior "Teamwork requires that members monitor each other's behaviors and action and feel free to provide and accept feedback based on monitoring

behavior" (p. 335).One very useful feature of the Salas, et al.(2004) article is that they identified instructional strategies to facilitate acquisition of key competences.

Systems Models

McGrath (1984) was the first group theorist to conceptualize the small group as a system. In his *Conceptual Framework for the Study of Groups*, he proposed group interaction process as the centerpiece of the framework with all other conceptual components of the framework either influencing or being influenced by group interaction. McGrath noted that the framework is intended as a model for systematically studying groups, metatheory, and is not intended to specify a particular theory.

The framework posits that there are four major classes of system input factors that influence the team's interaction process: 1) individual-level factors such as skills, attitudes, personality traits, gender, and age; 2) group-level factors such as structure, size and cohesiveness; 3) environment-level factors such as the level of environmental stress; and 4) task level factors relate to what the group is doing in an effort to achieve its goals. For example, in the present study developing a patient care plan would be a specific team task. McGrath theorized that the group interaction process itself is both the result of these inputs and that the inputs influence group outputs or outcomes. For example, an output of the interaction process for the geriatric interdisciplinary team would be the patient care plan. Potential outcomes related to the patient care plan could include clinical outcomes and/or patient/family satisfaction with the care provided.

The framework is important because it seeks to explain group interactions and explicitly acknowledges the role of individual-level skills. Important contributions of this

model include characterization of a group as an open, living system and focusing attention on individual-level skills as system inputs that influence the quality of group interaction. If the team is thought of as a system, then individual competencies can be considered as system's input variables (Burke, 2003).

The *Model of a Small Group as an Open System* proposed by Adams and Galanes (2000, 2003) provides a framework for examining the relations between constructs that influence small group functioning. The model extends McGrath's (1984) theorizing that small groups are composed of interdependent parts of a living system. The model shows how components of the system interact and influence group effectiveness. Model components include input variables, throughput or process variables and output variables with inputs and outputs connected by feedback channels.

System's inputs are the fuel needed for the system to work. Inputs include the human, physical, and/or financial resources that make it possible for the system to create output and outcome (Adams & Galanes, 2000, 2003). In this model, individual-level team competencies are system's inputs. Adams and Galanes (2000, 2003) identified personality traits, skills, abilities, technical expertise, values, attitudes, gender and ethnicity as individual-level system's inputs.

Although the *Model of a Small Group as an Open System* provides the framework for examining and explaining group structure, process and outcomes, there are no published empirical studies that use this Model. The individual-level inputs identified by Adams and Galanes were adopted for inclusion in the conceptual model of the individual-level team competencies that is proposed for the current study.

Summary of Existing Theories and Conceptual Frameworks

Identifying the individual-level competencies required for effective team interaction requires more empirical study. Very few team theories or conceptual models address the individual-level competencies required for effective team interaction. The few models that address this construct have done so at the macro level and have not teased out competency constructs. The lack of empirical work in this area limits what is known about the relationships between individual-level competencies, team interaction and team effectiveness. This void in the literature provides an opportunity for theorizing and empirically testing teamwork competencies.

Based on the above theories, there is evidence that team interaction is influenced by at least two broad classes of individual behaviors: task related behaviors and socio-emotional behaviors. McGrath (1964) introduced system's thinking to group research and in so doing focused attention on the interdependent nature of group structure, interaction, process, and outcomes. Tuckman (1965) established the gold standard of group development that is still widely used to diagnose and solve team interaction and performance issues. Gladstein's model provided empirical evidence that organizational and environmental context influences group interaction. Stevens and Campion (1994) provided empirical evidence for 14 skills required for effective teamwork. Adams and Galanes (2000, 2003) extended McGrath's ideas about groups as open and living systems and identified specific individual-level KSAs as system inputs. These theories all indicate that the competencies individuals bring to the experience influence the quality of

team interaction. However, there is still a need to confirm the influence of specific competencies on team interaction and to identify the structural relationships between individual-level competencies and team interaction.

A Framework for Individual-Level Team Competencies

The conceptual Model of Individual-level Team Competencies (*Model of I-LTC*) which follows is largely the judgment of the author and is based on interpretations of the small group/team literature across diverse disciplines and fields. While the literature contains many reports about team structure, development, interaction, effectiveness, and curricula designs there is little published research on the relationship between individual-level teamwork competencies and its impact on team interaction and team effectiveness.

However, a seminal study of individual level teamwork competencies that is relevant to the current study was conducted by Heilman (1977). She reported the results of her efforts to identify and prioritized individual-level competencies needed for effective team interaction. These competencies were then ranked by a panel of 20 experts in team development as "of highest importance" to "of little importance or significance" for teamwork. Competencies of highest importance included leadership, conflict-management, problem-solving, decision-management, and knowledge of the contributions of other disciplines. This empirical study is discussed in more detail in this chapter under the subheading for leadership communication skills.

Five assumptions underlie the *Model of I-LTC*. First, interdisciplinary healthcare teamwork is an individual skill. Healthcare teams may be more likely than other types of

teams to have individuals enter and exit the team on a routine basis due to either changing patient needs or staff rotation and turnover (Drinka & Clark, 2000). The best hedge against the potentially destabilizing effects of member turnover is to provide training on teamwork competencies as part of the professional education process and/or as part of professional development activities for all healthcare practitioners. From this perspective, teamwork is an individual skill. However, development of interdisciplinary training and education opportunities have, for the most part, followed funding opportunities and most opportunities have been in the field of gerontology (Holmes, 1999; Lavin, Ruebling, Banks, Block, Counte, & Furman, et al., 2001).

Second, the quality of team interaction is dependent upon the behaviors of each team member. This is not only true for the team environment but is generally true for all situations in which people interact. If the team is thought of as a system, then individual competencies can be considered as system's input variables (Burke, 2003). Team interaction includes behaviors such as patterns of information flow, coordination strategies, and communication routines (Gersick & Hackman, 1990; Klimoski & Mohammed, 1994).

Third is the assumption that competence for teamwork can be approached generically and need not be linked to a particular discipline or field of practice. Thus, the *Model of I-LTC* is aimed at individual-level team competencies that are transferable across disciplines and fields of practice.

Fourth, it is assumed that team structure and process can be modified to fit team goals and objectives. The proposed model is intended for teams in which leadership is

shared among its members. Shared leadership refers to a process whereby any team member can take on the role of leader based on the context of each situation and the type of knowledge and technical expertise required to address specific issues or tasks. There are almost as many definitions of the term "leadership" as there are researchers and practitioners who have studied the concept. Traditional leadership theories are hierarchical, much like the traditional medical model, with one leader and all other roles subordinate to the leader; whereas, team leadership acknowledges interdependent roles and collaboration requirements among team members (Salas, Burke, & Stagl, 2004).

Generally, leadership definitions focus on behaviors that influence or motivate others in pursuit of an objective. For purposes of this framework, leadership occurs when one team member influences another member or the full team for the purpose of achieving team objectives. Emphasis is placed on "achieving team objectives" rather than simply "influencing others" as the key criteria for leadership because knowledgeable and well trained team members are less likely to be overly influenced by dominant personalities and hidden agendas that can steer the team away from its goals and objectives.

Shared leadership within healthcare settings is a relatively new phenomenon that is rooted in the healthcare teamwork literature. The traditional healthcare model is hierarchal. Physicians reside at the top of the hierarchy and retain sole decision-making authority for patient care. Drinka and Clark (2002) and Garner and Orelove (1994) noted that the long standing tradition of delivering patient care based on the hierarchical relationships between healthcare professions is one of the greatest challenges facing the

interdisciplinary healthcare team. One methods for meeting this challenges was offered by Coogle, Parham, Welleford, et al., (2002), they noted that evaluation of interdisciplinary education programs could "...establish how to effectively emphasize shared leadership and participation, while countering the validity of Physician Centrality" (p. 155). In the healthcare team literature, physician centrality is the term that identifies the traditional role that physicians play as sole authority for patient care decision-making.

The fifth model assumption is that the skills required for effective interpersonal communication are essentially the same skills that are required for effective small group communication. Some research studies identify interpersonal communication skills and small group communication skills as separate constructs (Council of Chief State School Officers, 1995). Other studies have treated small group communication skills as a subcategory of interpersonal skills (Stevens & Campion, 1994, 1999). The only difference between the two constructs seems to be the number of individuals involved in the communication process. Generally, definitions of interpersonal communication include three components: (1) face-to-face interaction; (2) the interaction involves a dyad (two people); and (3) the intent of the communication is to shape the behavior of the other person in the dyad (McConnell, 2004). Alternately, Adams and Galanes (2003) define small group communication as "an interactional process that occurs among three or more people interacting in an attempt to achieve commonly recognized goals either face-to-face or through mediated forms" (p. 48). Operational definitions for both interpersonal communication skills and small group communication skills have included

factors such as problem-solving, conflict resolution, negotiation, collaboration, encouraging, persuading, and/or motivating.

Communication skills have often been treated as the narrower construct and have been most often defined as writing, speaking, listening, and nonverbal signals. However, that definition fails to recognize that communication is a purpose driven process. Rarely do individuals write, speak, listen or send nonverbal signals without having a purpose. As an example, in the team setting, speaking and listening skills are required for problem discussion and resolution, intervening effectively to improve team functioning, persuading others to adopt one's ideas or suggestions, and for helping draw out team members who are not participating actively in meetings. Whenever a team member performs one of these behaviors, that member is providing a leadership service to the team. These communication behaviors move the team toward its goal(s) and are more generally referred to as distributed leadership (Adams & Galanes, 2003).

An important principle for self-managed small groups, such as interdisciplinary healthcare teams, is that performance of functions required for the team to accomplish its mission is the responsibility of all the team members. In the proposed Model of I-LTC, distributed leadership is the concept underlying the communication leadership skills construct.

The proposed Model of I-LTC describes the theorized relationships between predisposing factors, knowledge of group development and process, technical professional abilities, leadership communication skills, and team interaction and is based on the review and interpretation of the literature. The Model specifies variables that may

operationalize each construct. Future research using this model could add to our understanding of the dynamic relationships among the framework's constructs and variables. The Model is presented in Figure 1 and the nature of the constructs and associated variables will be elaborated in the following sections.

Knowledge of Group Development, Dynamics and Process

Effective team interaction rests on a foundation of conceptual and experiential knowledge about group development, dynamics and process. This knowledge can be used to improve interaction, diagnose team problems and propose intervention strategies that will move the team in the direction of goal accomplishment. Team training seeks to develop the individual's ability to function interdependently with other professionals. Individuals who are knowledgeable about team development, dynamics and process are more likely to be able to describe and apply the associated skills as well as be highly effective in their interactions with other team members.

Team training is defined as training that imparts knowledge about effective team skills and behaviors. Team training is different from interdisciplinary education which is focused on technical/professional curricula content presented in learning settings that bring together learners and/or faculty from more than one health professions school, department or program.

Some interdisciplinary education curricula do include modules on teamwork training. For example, two of the three curriculum content areas for geriatric education proposed by the Health Resources and Services Administration (HRSA) (1995) were focused on group dynamics and group interaction. As proposed by HRSA the three

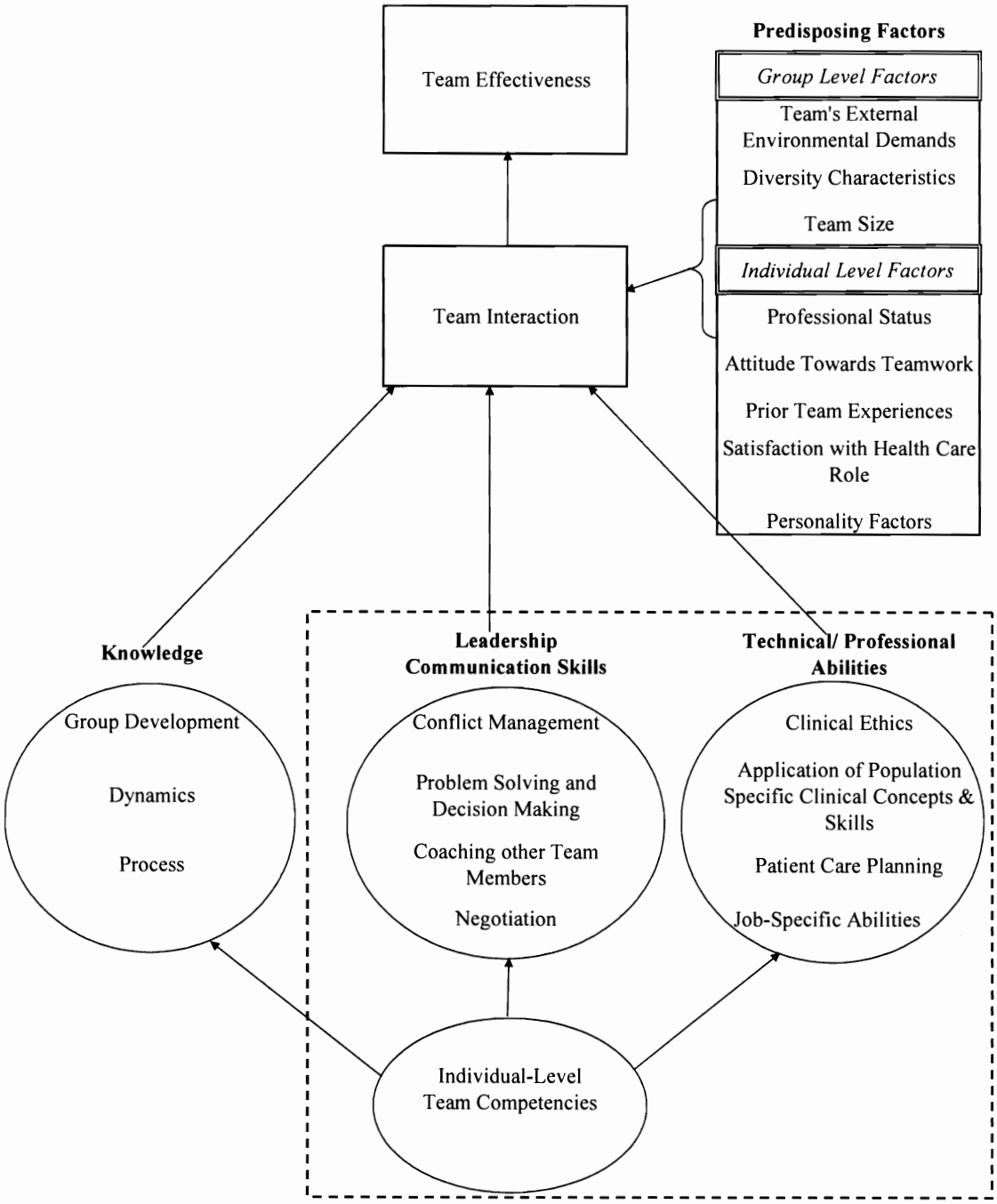


Figure 1: Model of Individual-level Team Competencies (Model of I-LTC)

Note. Only the section inside the dotted lines will be evaluated as part of this study.

content areas were: (1) "...principles that govern the functioning of groups," (2) "...concepts that deal with processing of group interactions,' and (3) "... the content and context variables that must be dealt with in the care of geriatric patients" (p. 68). Clearly, HRSA intent was that geriatric education focus not only on the technical aspects of patient care but also must address the interdisciplinary team process.

For purposes of the proposed Model of I-LTC, the term 'group development' refers to the way groups form, change over time, interact, achieve its goals, and dissolves. The term "group dynamics" refers to the types of interactions that take place within the group; and the term 'group process' refers to how the group carries out its procedural functions such as goal setting and agenda making.

Very few authors have reported on interdisciplinary healthcare team training programs that were theory-driven. For the most part, the literature describes model programs, curricula content, and experiential learning modalities (Greiner, et al., 2003; O'Neil & Pew Health Professions Commission, 1998; Pew Health Professions Commission, 1991). This void in theory-driven training designs hinders development of an evidence base about what is both doable and effective across many different settings. However, the evidence base from research on adult learning principles indicates that learning occurs when learners are actively engaged, have opportunities for interaction with others, and are presented with challenging situations or questions that require critical thinking skills (Gagńe, Briggs, & Wager, 1992).

Team training that provides learners with opportunities for clinical application of what they know is generally considered better than the didactic method alone for

developing competencies. Cannon-Bowers, Tannenbaum, Salas, and Volpe (1995) found support for this learning principle in their research on effective team training. They found that individuals who learned teamwork skills in team training settings were not only more knowledgeable but their teamwork skills were also more honed than were the teamwork skills of individuals who received only didactic exposure to teamwork principles.

One longitudinal study suggests that interdisciplinary training fosters listening skills, sensitivity to bias and the ability to tolerate and synthesize diverse perspectives (Newell, 1990). Long (1996) reported evaluation results of a health professions team training workshop. The purpose of the workshop was to improve interdisciplinary coordination. It was reported that workshop participants came away from the training with a better understanding of the roles of other professions. In addition, at six-month follow-up, interdisciplinary communication had improved and participants indicated that they had made changes in their collaborative practice as a result of the teamwork workshop.

In their evaluation of a multiyear geriatric interdisciplinary team training program, Coogle, Parham, Cotter, and colleagues (2005) found that age and years of healthcare experience were predictors of training related changes in attitude about the quality of care provided by healthcare teams. These authors also found evidence that a minimum of four hours of training is required to affect positive change in trainees' perceptions of their team skills.

In their empirical study of team performance, Marshall and Begeman (2005) identified 17 factors that predict team performance and found that technical expertise was least predictive of team performance. The authors concluded that technical expertise alone is necessary but not a sufficient predictor of the quality of team interaction and performance. The top predictors of team performance, in descending order, were trust, goodwill and cooperation, clarity of purpose and information sharing. In terms of individual-level team competencies, these findings suggest the need for individuals to understand the dynamics of the trust-building process. In addition, each individual must understand how to contribute to trust-building through activities such as self-disclosure, being an empathetic listener, avoiding stereotyped judgments, and providing emotional security for all team members (Cragan & Wright, 1999).

One method for facilitating trust-building is participating in interdisciplinary clinical education experiences. Hayward, Powell, and McRoberts (1996) studied perceptions of health professions students towards other professions. They found that interdisciplinary clinical education significantly increased students' positive perceptions of the professional competence of other disciplines as well as their own. These investigators concluded that interdisciplinary training provided the extra benefit of helping trainees build trust and respect for the technical abilities of other professions.

There are a number of interdisciplinary team training models that were effective in helping learners become knowledgeable of and skilled in group development, dynamics and process. In each case, a range of learning strategies were employed including small group discussion sessions; clinical team based training sessions,

observation experiences, preceptorships, case studies, and simulations (Heinemann, 1994; Lavin, et al., 2001). The Geriatric Interdisciplinary Team Training (GITT) program, the source of data for the current study, is one such model and is summarized below.

The Geriatric Interdisciplinary Team Training (GITT) program was designed to bring together health professions trainees from different disciplines to learn the conceptual knowledge and skills necessary to provide interdisciplinary collaborative care for older adults. The program involved classroom-based instruction and clinical experiences for trainees from medicine, nursing, and masters-level social work as well students from 13 other disciplines. According to Hyer (1998), one of the program's core goals was to "develop well-tested curriculum for geriatric interdisciplinary team training" (p. 5).

GITT curricula and implementation materials focused on six topics: team and team work, team member roles and responsibilities, team communication and conflict resolution, care planning process, multiculturalism and ethics within teams (Hyer, 1998). Five of the six topics are standard team training modules, irrespective of the team's work environment. However, the topic on 'ethics in teams' is unique to healthcare settings. Rather than being a team competency, clinical ethics is most likely belongs to the technical/professional ability construct.

Clinical ethics is a response to the *Patient Self Determination Act* which gives patients the right to make choices and decisions about their medical (Ulrich, 1999). Ethical issues that are very likely to be encountered by geriatric teams include: patients' capacity to share in decision-making, treatment refusals by patients or clinicians, and

death and dying issues. The framework used for clinical ethics inquiry can serve the dual role of helping trainees improve ethical reasoning as well as serve as a model for teaching the processes involved in problem-solving and decision-making.

Technical/Professional Abilities

Healthcare organizations are composed of highly trained technical professionals. This is particularly true for interdisciplinary healthcare teams that are composed of members with specific expertise and knowledge unfamiliar to other team members. Each individual must freely and effectively share their profession's technical expertise and must synthesize information shared by other team members to create new knowledge and/or generate alterative solutions for the numerous issues that require team action (Hollenbeck, et al. 1995; Hutchins, 1990). For example, each discipline must share its technical professional expertise to facilitate problem-solving and decision-making in the development of effective geriatric patient care plans. While technical expertise is essential to accomplishing the team's mission, technical expertise alone is not sufficient for effective team interaction (Salas, et al., 2004).

The range of technical professional abilities that could be measured by this construct should be representative of all discipline-specific abilities of the team's members. The GITT Implementation Manual (2001) provides detailed information on the factors described in this section.

Clinical Ethics

Clinical ethics is one area of technical expertise that is common to almost all healthcare disciplines. Clinical ethics is concerned with ethical problems that arise in the

care of patients (Cassel, Mezey, & Bottrell, 2002). All members of interdisciplinary healthcare teams, particularly geriatric team members, should possess the ability to recognize ethical dilemmas, frame and evaluate ethical issues and engage in ethical deliberations.

Application of Population Specific Clinical Concepts and Skills

The application of population specific clinical concepts and skills is a patient-centered proactive way of looking at patients not just as individuals but as members of groups with shared health care needs. The interdisciplinary healthcare team would approach the patient not just as individuals but as member of group with shared health care needs. For example, older patients with congestive heart failure (CHF) would constitute a specific population group and individuals within this group can benefit from the clinical practice guidelines developed for the population to which they belong. The interdisciplinary team would target its interventions in context with the culture, health status, and health needs of a CHF patient based on her membership in that group. The patient care plan would incorporate evidence-based medicine, cost-effective practice, and continuing improvement of outcomes" (American Academy of Family Physicians, 2005).

Patient Care Planning

Patient care planning brings the principle of patient centered care to the forefront; because, the patient's and family's goals and objectives are the symbolic boundaries of the care plan. Care planning is the process of integrating discipline specific assessment data into a comprehensive plan of care (GITT Implementation Manual, 2001; Holland, Roberts, Stewart, & Wright, 1994). The plan itself can span the continuum of acute-care

medical needs to social and/or end-of-life care issues. It is in the care planning process that team members must understand not only their own discipline's contributions but must also come to appreciate the roles and functions of team members from other disciplines.

Job-Specific Abilities

Each team member belongs to a discipline that has it own unique body of knowledge, skills, and abilities specific to its healthcare technical responsibilities. For example, a geriatrician is a medical doctor trained in the diagnosis, treatment, and prevention of disorders affecting older people. In the team setting, the geriatrician is responsible for ensuring that medical issues are well addressed in the care planning process. Another example is the job-specific competencies of the social worker. The social worker is trained in psycho-social assessment to identify the strengths and weakness of the client/patient and/or family and in identifying resources to maintain or restore psycho-social functioning. In the team setting, the social worker is often responsible for helping the family prepare for the transition of the geriatric patient from one care setting to another (GITT Implementation Manual, 2001).

Leadership Communication Skills

Communication is the vehicle that the team uses to accomplish much of its mission through the exchange of information between individual team members and within the team process. All interaction involves some form of communication. It is through communication that members of the team get and give feedback, address clinical issues, collaborate, coordinate, problem solve, resolve conflict, and make decisions.

Communication skills are believed to be an important individual-level competency because during group interactions, members are always communicating either verbal or nonverbal signs to each other, which elicit interpretation and response from other .Horwitz (1970) noted that "...upon occasion, every single team member initiates some activity or other in which colleagues join, and succeeds even fleetingly in inducing the others to follow" (p. 19). Horwitz concludes that leadership is a function and should be "...assumed by those with the best information and by those closest to the problem" (p. 19).

Leadership can be thought of as providing structure, direction and support to team members and may include such functions as conveying information, seeking input from team members, offering solutions to resolve disagreement among team members, drawing out members, and effectively intervening to improve team functioning. As defined by Cragan and Wright (1999), small group leadership is "...communication that positively influences the group to move in the direction of the group's goals" (p. 184). This definition implies that leadership occurs through the process of communication and can be performed by a designated leader or by any group member. In some of the literature, the principle of sharing leadership among team members is referred to as distributed leadership. Within the distributed leadership principle, the best team leadership allows each member to exercise leadership around particular areas of expertise.

Leadership communication skills are concerned with shared influence between and among team members. Just as no single person can deliver comprehensive health

care, no single person can be expected to lead the interdisciplinary healthcare team in all situations. In fact, teamwork implies that the mission and objectives cannot be accomplished using the knowledge and skills of a single individual. Interdisciplinary team leadership may be best thought of as a function rather than as a status or position. In this context, leadership is assumed by the team member who can best facilitate achievement of the team's objective for the specific problem being addressed. It is therefore necessary for each member to be concerned with how the team is interacting and functioning. Each member exerts leadership to keep the team process moving towards shared goals and objectives. From this perspective, each member can take on the role of leader based on the context of each situation and the guidance needed for that situation.

When leadership is shared, each member of the team has a dual interest in the team's development, dynamics and process. This dual role is sometimes called participant-observer perspective (Adams & Galanes, 2003; Sampson & Marthas, 1981). The participant-observer role requires each team member to simultaneously engage in the group's dynamics and process and to adopt a somewhat more analytic role (as an observer). The observer is attentive to patterns of interaction and group process factors. It is the observer who may be best able to recognize, through both verbal and nonverbal modes of communication, when the team is not functioning well. The observer has the distance necessary to see what is taking place and may be best able to perform the leadership function of refocusing the team on its objectives.

Likert (1961, 1967) summarized research on leadership behaviors and identified three behavioral clusters. The first cluster was identified as task-oriented behaviors and included behaviors such as helping other team members, establishing goals, coordinating /planning work and providing resources. The second cluster called relationship-oriented behavior was defined as concern for relationships with other team members. The third cluster, participative leadership, included facilitating participation of other team members in decision-making, conflict resolution, and team discussion. These clusters are consistent with Bales' (1950, 1999) empirical evidence that individuals provide input into groups through two broad categories of observable leadership behaviors: instrumental leadership and socio-emotional leadership.

Levine's (1973) research demonstrated that distribution of control within teams is important and impacts team outcomes and team member satisfaction. His research suggested that leadership within teams should be widely distributed and that the team should have maximum control over its operations. According to Levine (1973), distribution of the leadership role should include behaviors such as encouraging increased interaction between team members when control seems unequally distributed. The importance and value of behaviors such as encouraging team members to discuss disagreements and providing team members with appropriate mechanisms for handling conflict have been emphasized as key leadership skills (Levine, 1973; Hackman, 1990).

Heilman (1977) reported the results of a study that identified and prioritized individual-level competencies needed for effective team interaction. Her review of healthcare, social service, behavioral science and education and human resource

management literature resulted in a list of 100 competencies. The list was refined and reduced to 51 competencies with relatively little overlap. These competencies were then ranked by a panel of 20 experts in team development as "of highest importance" to "of little importance or significance" for teamwork. Competencies of highest importance included leadership, conflict-management, problem-solving, decision-management, and knowledge of the contributions of other disciplines. Next in importance were 18 competencies associated with team knowledge and attitude towards teamwork. The final category included 16 competencies, many of which were related to professional/technical expertise.

Manz and Sims (1987) developed a taxonomy of leader behaviors based on their empirical investigations of leadership roles for self-directed work teams. Their research showed strong correlations between behaviors in the taxonomy and ratings of leader effectiveness. However, the impact of these behaviors on team process and team member behaviors has not yet been documented in the literature.

Cragan and Wright (1999) identified twenty leadership communication skills that all group members should exhibit in order to move the group towards accomplishing group goals. These skills were grouped into three domains: task, procedural and interpersonal communication leadership. The seven task skills focus on the generation of enough ideas to move the group toward task achievement. The seven procedural skills focus on group operational functions such as goal setting, agenda making and clarifying discussion points. The six interpersonal communication leadership skills focus on group member socio-emotional needs, conflict resolution and advocacy of opposing ideas.

Many of the TSS items map well with leadership communication skills proposed by Cragan and Wright (1999).

Conflict Management Skills

Conflict is a strong disagreement between two or more individuals around an issue that is personally meaningful to the parties involved (Adams & Galanes, 2000). Since no two people view the world exactly the same way, disagreement is normal, permissible and essential for healthy team interaction. Conflict stems from differing viewpoints but is not inherently negative. Wheelan and Hochbberger (1996) posit that conflict can be used to establish a safe environment because trust is built once group members "...believe that they can disagree and not be abandoned or hurt for their differences" (p. 150). Conflict resolution skills are important because these skills not only facilitate rebuilding team unity when disagreement occurs, but these skills also help to frame conflict in ways that minimize the potentially destructive nature of conflict.

Adams and Galanes, (2000) identified four primary sources of group conflict: (1) the personal and collective needs of individual team members, (2) demands of the external environment including the organization, (3) patient family members and (4) the quality of team leadership. Available empirical evidence suggests that conflict resolution skills are a form of negotiation that results in a compromise that everyone can support.

Hall's (1996) *Conflict Management Survey* is purported to have utility for assessing conflict resolution skills. The Survey's psychometric properties indicate that it is both valid and reliable and may serve as one measure for assessing this construct.

Negotiation Skills

Negotiation can take many forms. Within the context of interdisciplinary healthcare teamwork, negotiation is intended to be a cooperative rather than an adversarial or competitive process. In the cooperation context, negotiation refers to the coordination process in which team members share information about what they need from each other and offer help to others in the performance of various team role demands. It is the degree of coordination that takes place around functions, such as sharing information about the patient's progress and coordinating treatment plans, that distinguishes teamwork from non-team professional interaction.

Additionally, it is likely that there will be some degree of role negotiation as the process of task differentiation and role boundary setting is played out during the team's Storming stage (Rubin, et al., 1975; Tsukuda, 1990). After the team defines its goals and objectives, it must identify the tasks and activities that will lead to accomplishing those objectives. Then, team members negotiate who performs each task. On its surface, one would assume that the various healthcare practice areas are unique and present little opportunity for role overlap. However, changes in the healthcare delivery system have required that professionals acquire new knowledge, skills and expertise which, in some cases, have modified role relationships (Drinka & Clark, 2000; Tsukuda, 1990). As an example, assessment tools that were formerly in the exclusive domain of the psychologist are now routinely used by social workers, speech therapists and, in some cases, nurses (Losen & Losen, 1994).

The physician and nurse relationship continues to evolve and the semi-independent stance of the more traditional physician role may be the source of some intra team conflict. Role negotiations between these two team members may be an ongoing process requiring periodic re-negotiation (Drinka & Clark, 2000; Tsukuda, 1990).

In interdisciplinary healthcare settings, role negotiation is not without its potential problems given the hierarchical nature of professional roles and due to differences in educational requirements. Generally, healthcare disciplines are trained in isolation from one another. This isolation limits what individuals know and understand about other disciplines and can lead to problems in clarifying roles. Given the differences in educational requirements for the various disciplines, there is the potential that some individuals may experience a degree of intellectual intimidation associated with their traditional professional socialization. The antidote for this problem is interdisciplinary clinical education. Research indicates that interdisciplinary clinical training significantly increases students' positive perceptions of the professional competence of other disciplines (Hayward, Powell, & McRoberts, 1996).

Problem-Solving Skills and Joint Decision-Making Skills

Interdisciplinary healthcare teamwork is largely the work of communicating for the purposes of solving problems and making decisions about patient care issues. Problem-solving and decision-making are likely different aspects of the same analytical process given that solving a problem requires the adoption and implementation of at least one decision.

Problem-solving is the work of choosing issues that require attention, setting goals, and finding or designing suitable courses of action (Adams & Galanes, 2003; Cragan & Wright, 1999). The primary goal of the interdisciplinary healthcare team is to attend to patient problems and produce a specific outcome favorable to the patient. The patient centered team will involve the patient and her family in the process. For example, the team, an 80 year old hip fracture patient, and the patient's family will need to reach consensus on the post hospitalization plan for the patient. Each participant in the process will likely play several roles in choosing issues to address and in proposing courses of actions.

Decision-making is concerned with the team's "ability to integrate information, use logical and sound judgment, identify possible alternatives, select the best solution, and then evaluate consequences" (O'Neil, 1997, p. 415). Team members must be attentive in considering the impact of potential alternatives on subsequent actions. It is not uncommon that a decision can shape subsequent alternatives. For example, a decision not to provide a surgical intervention for hip fracture almost certainly precludes the possibility that the patient will be restored to her pre-fracture baseline. Since decision-making is the process of arriving at a judgment based upon feedback from multiple sources, the feedback loop should be a patient-centered process. Thus, joint decision-making involves the interplay between and among the team's health professionals and the patient. However, the Institute of Medicine (2001) noted that physicians tend to dominate decision-making about healthcare in all settings including teams.

Lichtenstein, Alexander, McCarthy, and Wells (2004) hypothesized that professional status affects the level of participation and perceived influence that individual members have in the team's decision. They studied members of long-term neuro-psychiatric teams based in 29 U.S. Department of Veterans Affairs hospitals. They found that on average, "...team members reported that they had less influence on team decision-making than they felt they should have" (p. 330). Additionally, the path model indicated a gender effect in terms of level of participation and perceived influence on team decision-making. Specifically, males tended to have high satisfaction with autonomy which in turn predicted higher values for perceived influence on team decision-making. In general, males comprised the vast majority of the higher status clinical occupations. The authors concludes that perceived status has both "...attitudinal and behavioral consequences for individual team members" (p. 332).

Tindale, Kameda, and Hinsz (2003) noted that under the right conditions, dissent and diversity may enhance group decision-making. This finding has been attributed to the fact that heterogeneous (teams of dissimilar age, gender, race, discipline) groups tend to have more unshared information than homogeneous groups. Greater degrees of unshared information limit cohesiveness (Tindale et al., 2003). One implication of this finding is that diversity and dissent can be a hedge against groupthink which is associated with excessive cohesiveness (Hogg & Hains, 1998).

Problem-solving and decision-making are essential functions for interdisciplinary healthcare teams. The influences of factors such as professional status and diversity on these functions present important team training topics and topics for rigorous research.

While, status linked behaviors and attitudes may diminish the intended synergy of teaming, diversity may enhance the range of ideas that the team considers. Effective leadership communication may be the best tool for balancing the influence of professional status on team interaction. Leadership communication is also needed to promote cohesiveness in heterogeneous teams while at the same time ensuring that the team problem-solving and decision-making processes are flexible.

Coaching Other Team Members

Effective leadership communication requires that team members be attune to interactions within the team and that members be sensitive and supportive of the needs of its members. Coaching or being coached requires an atmosphere of openness and respect among members. Coaching may involve skills such as drawing out members who are not participating actively in meetings, intervening when the team is not functioning well, or handling disagreement between members in a way that keeps the patient's needs at the center of the process. In addition, coaching could take the form of skillfully minimizing the pursuit of vested interest by some members at the expense of one or more other team members. Further, coaching could take the form of instructing other or modeling good teamwork behaviors. Efforts to coach others require that situations be dealt with in a positive manner.

Predisposing Factors

There are two categories of predisposing factors based on whether the factor is measured at the individual-level or measured as an aggregate group level factor. As previously shown in Figure 1, the team's external environmental demands, diversity

characteristics and team size are group-level factors while professional status, attitude towards teamwork, prior team experiences, satisfaction with health care role, and personality are individual-level factors.

Predisposing factors are the attitudinal, personality, demographic and other factors that motivate and guide an individual's behavior or that influence team functioning. However, they are not competencies; rather, predisposing factors have the potential to confound or modify team interact and should be controlled in empirical studies designed to evaluate team interaction and/or team effectiveness. In some cases, it may be important to show that a given factor, such as gender or race, is not significantly related to team interaction.

When a randomized study design is not possible, it is important to establish that relevant predisposing factors have not confounded or modified the results of a training intervention. In this case, the goal is to be able to argue that the training intervention is responsible for enhancing competencies and that any observed change is not the result of an unequal distribution of predisposing factors. Predisposing factors can be operationalized by measures such as the team's external environment, professional status, attitude towards teamwork, satisfaction with prior team experiences, satisfaction with healthcare role, diversity variables, personality factors, and team size. It is assumed that there are interactions between professional status, attitude towards teamwork, satisfaction with prior team experiences and satisfaction with healthcare role. However, empirical evidence supporting or refuting this assumption is needed. Therefore, these factors are discussed separately, but may be aspects of a single construct.

Group-Level Factors

Team's External Environment Demands. The external environment refers to the organizational and patient specific setting for which the team operates. This includes organizational structure, social systems and norms, and patient specific factors that affect the operation of the team. According to Drinka and Clark (2000) one of the most important variables for the survival of interdisciplinary healthcare teams (IHCT) is the organizational component. The IHCT must monitor the organization climate and interact with the administration to ensure support for the team's work. Variables for this factor could include the type of healthcare organization, administrative structure, treatment policies and communication channels. An especially important variable is the level of understanding of the needs and expectations of the patient and the patient's family.

Teams work within larger organization system and the effective team is viewed by all levels of management as an integral part of the healthcare organization. Hackman's (1983, 1987) normative model of work team effectiveness emphasizes the effect of the organizational context in defining the boundaries of the team's process, interaction and performance.

Diversity Variables. In a review of the literature on teams in organizations, Guzzo and Dickson (1996) concluded that "in spite of its recent popularity, there is little consensus on what constitutes diversity and how it affects group interaction" (p. 331). Generally, members of interdisciplinary healthcare teams differ on a number of characteristics such as age, gender, race/ethnicity, geographic origin, cultural values, personality, educational background, socioeconomic background, and/or professional

status. Some of these characteristics have been found, in several studies, to be related to how well team members interact and the degree of participation and openness (Cohen, 1994; Webb, 1995; Jehn & Shah, 1997; Kirchmeyer & Cohen, 1992). Other studies show that diversity is associated with high levels of turnover and dissatisfaction among team members (Ruderman, Hughes-James, & Jackson, 1996; Jehn, Chadwick, & Thatcher, 1997). Still other studies show that multicultural groups have more interpersonal communication difficulties than homogeneous groups (Jackson, Stone, & Alvarez, 1993; Stening, 1997; Triandis, Hall, & Ewen, 1965).

A few studies have shown that diversity can lead to creative problem-solving, particularly when the environment in which the team operates is undergoing significant changes (Hambrick, Cho, & Chen, 1996; Kirchmeyer & Cohen, 1992; Bantel & Jackson, 1989). However, the most convincing evidence relates to the skills that individuals bring to the team process. Teams composed of members with diverse technical/professional skills tend to generate more creative solutions than do teams composed of members with similar skill technical/professional skills (Maznevski, 1994; Watson, Kumar, & Michaelson, 1993).

The aforementioned studies may not be generalizable to interdisciplinary healthcare team because no such teams were included in samples for these studies. However, there is implicit support for the assumption that the skills of multiple disciplines are required to appropriately address the healthcare and psychosocial needs of vulnerable healthcare populations. Interdisciplinary healthcare teams are inherently composed of members from different and autonomous professions. Each profession is

shaped by its own unique body of knowledge. As discussed as part of the professional status subheading, the healthcare system's dependence on the competencies of a discipline provides the source of discipline specific power and status.

An important strength of the IHCT approach is the rich mix of technical abilities that each team member brings to the process. Yet, healthcare organizations are hierarchical and professional status is closely linked to one's position within the hierarchy. Further, hierarchy establishes patterns of power in the ways that professionals relate to one another. The hierarchical model of patient care is perhaps one of the greatest challenges facing the interdisciplinary healthcare team (Drinka & Clark, 2000; Garner & Orelove, 1994). Consequently, the willingness of team members to place the patient at the center of the team's activities, depends, to some extent, on team members being willing to know and respect the role and functions of each team member.

Silver, Troyer, and Cohen (2000) studied the effects of social status on information sharing among members of a decision-making team. The teams in the study had had explicit training on team building. Additionally, all teams received familiarization training on the influence of status processes on the effectiveness of teamwork. The study authors found "...the amount and content of members' participation was systematically related to their status in the group" (p. 21). Contribution of ideas and opinions to the team's decision-making process was highly associated with status within the organization. Higher status team members had higher contribution rates than did team members who occupied lower social status levels within the organization. Although the Silver, and colleagues (2000) did not specifically include an interdisciplinary

healthcare team, the study does suggest that even the most well trained interdisciplinary healthcare team members will be constantly challenged to create an environment that promotes the free flow of ideas.

Team Size. One team characteristic that seems likely to be associated with a number of other team characteristics is team size. For instance, as team size increases so should the collective abilities of the team and the diversity within the team. On the other hand, as team size increases, one would also expect decreases in familiarity between team members. Lichtenstein, et al. (2004) noted that team size is related to individual integration into the team and that the larger the team is the more likely it will have problems with role definition and boundary formation.

Katzenbach and Smith (1999) identified six elements that must be satisfied to create a self-managed business team. The first of these is that the team must be composed of less than twelve members. They posit that size matters because the larger the team, the more likely it will have trouble interacting constructively and creating an environment of joint accountability for the team's product(s).

Siegler, and colleagues (1998) argued that healthcare teams are likely to require a much more diverse range of skills than are other kinds of business teams. Depending on the needs of patient, the team may have as many as twenty members. Healthcare teams are more likely than other business teams to have members who enter and exit the team as their skills and expertise are needed. For example, issues related to end-of-life care may require expertise in bioethics and/or hospice care. While these professionals may be

permanent team members, they need not be present for all team deliberations; rather, they enter the process where and when needed.

Individual-Level Factors

Professional Status. Healthcare is an elaborate system of specialized knowledge, technical procedures, and rules of behavior. The various healthcare disciplines emerged as a nature consequence of increasing technical complexity of the delivery of patient care (Califano, 1986; Shi & Singh, 1998; Starr, 1982). Each discipline is associated with a body of competencies, values, roles and attitudes (Drinka & Clark, 2000; Starr, 1982). According to Starr (1982), the healthcare system's dependence on the competencies of a discipline coupled with the professionalization process provides the source of power and autonomy associated with a discipline. Thus, the rise inequalities in the professional status are primarily associated with the discipline's power and autonomy.

Physicians stand at the pinnacle of existing power relationships and hierarchies among the healthcare professions followed by dentist and nurses. The various allied healthcare professions contend for positions within the hierarchy using the professionalization process as a means to autonomy and status. Arguably, social workers have eclipsed many of the allied health professions in the attainment of status within the healthcare hierarchy (Institute of Medicine, 2001).

One of the factors affecting the way in which professionals interact on the team is professional status. The collaborative team must communicate effectively and share patient care responsibilities, and members must be viewed as equal and complementary (Pew Health Profession Commission, California Care Consortium, 1995). Although

workers in healthcare settings have always been expected to collaborate, power relationships have always shaped the collaborative process. However, the teamwork model of collaboration places team members in equal and complementary roles and some healthcare professionals fear that professional identity and power may be diluted through the rise of interdisciplinary team collaboration (Headrick, Wilcock, & Batalden, 1998). Given the perceived threat to professional identity and power, team members must be aware of the ways in which status between professions is expressed and influences team interaction.

Drinka and Clark (2002) noted that the practice framework for each discipline includes socialization and identify formation that influence the ways that professionals view patient problems, communication about those problems and problem solve around those problems. Each profession socializes its members differently with regard to role, values, and practice. For example, physicians are socialized around the biomedical model of patient care while nurses hold human dignity at the core of their socialization process. Drinka and Clark (2002) concluded that acquiring professional judgment in collaborative teamwork requires that professionals be trained to hear the voices of other professionals in ways that allow for adoption of patient-focused solutions.

There is some empirical evidence that professional status influences participation in the team decision-making process and that the individual's perceived sense of autonomy was linked to the occupational hierarchy of the various healthcare disciplines (Lichtenstein, et al., 2004). The authors concludes that perceived status has both "...attitudinal and behavioral consequences for individual team members" (p. 332).

Attitude Towards Teamwork. The term attitude has been defined in a number of ways. For the purpose of this conceptual model, attitude is a person's general positive or negative feeling concerning the performance of a specific behavior (Ajzen & Fishbein, 1980; Godin & Kok, 1996). Two important aspects of the attitudinal concept are that attitude predisposes an individual toward a particular behavior (Ajzen & Fishbein, 1980) and that a positive attitude promotes learning (Woldkowski, 1993). Cannon-Bowers, and colleagues (1995) indicated that attitude is an essential competency because research has shown that job-related attitudes can have an impact on performance.

Trainees who hold a positive attitude toward teamwork are expected to be more motivated to participate than will be trainees who have a negative attitude toward teamwork. The training and development research literature has found a positive relationship between attitudes and motivation to be trained (Clark, Dobbins, & Ladd, 1993; Facteau, Dobbins, Russell, Ladd, & Kudisch, 1995; Fishbein & Stasson, 1990; Maurer & Tarulli, 1994). For most health professions, teamwork training is an elective course rather than a requirement. Therefore, assessing and interpreting attitude towards teamwork as a pretest/posttest measure of training impact may have limited utility given that trainees may be predisposed to facilitating the intent of the training program. Specifically, students who choose this elective are already predisposed to wanting to be a good team member.

Some researchers argue that experience and education does not necessarily lead to adoption of a specific set of attitudes. Rather, experience and education leads to increased awareness of the attitudes that are considered appropriate for a given training or

work setting. Consequently, measures of attitude are prone to social desirability responding (Clark, et al., 1993; Facteau, et al,, 1995; Maurer & Tarulli, 1994). However, the potential problem of socially desirable responses may be an indication that the assessment tool lacks sensitivity and that a more focused measure of attitude may be needed. The four attitudes listed below were identified by Milanovich, and colleagues (2000) as important measures that may be predictive of effective team interaction and include:

1) attitudes individuals have towards working as a team (attitudes);
2) a willingness to remain in the group (morale);
3) a disposition to receive and value information from other team members (cooperation); and
4) the beliefs that individuals have about the competencies necessary for success (collective efficacy).

Several attitude scales have been validated for use in healthcare settings and may serve to operationalize aspects of the attitude concept proposed in the *Model of I-LTC*. These two scales are briefly described here. The Interdisciplinary Education Perception Scale (IEPS), developed by Luecht, Madsen, Taugher, and Petterson (1990), is an 18-item Likert-type scale questionnaire that measures attitudes toward cooperation between disciplines on four factors: competence and autonomy, perceived need for cooperation, perception of actual cooperation, and understanding others' value. This instrument is of value in assessing pre/post training attitudes of trainees in interdisciplinary setting.

Heinemann, Schmitt, Farrell, and Brallier (1999) developed a scale to measure general attitudes about healthcare teams. This scale contains two valid and reliable subscales. One subscale operationalizes team members' perception of the quality of care delivered by healthcare teams. The second subscale, measures team members' attitudes toward physician authority within the team. The scale's authors believe that it is best used as an evaluation tool for a pretest/posttest measure of training outcomes.

Prior Team Experiences. Prior team experience usually lays the foundation for the ways that individuals view themselves in relation to a team. Thus, prior team experience may shape an individual's attitude towards teamwork (Drinka & Clark, 2000). Individuals who perceive their team as more highly developed will be more satisfied compared to individuals that perceive their team as less developed. Additionally, individuals who have prior experience serving on teams that manage conflict effectively will have greater satisfaction with their team experience.

Satisfaction with Healthcare Role. The changes that are occurring in healthcare delivery system are also causing shifts in professional roles, identities, and patterns of practice (Drinka & Clark, 2000). These changes may influence the level of satisfaction that healthcare providers have with their roles/jobs. In this sense, role or job satisfaction is likely an individual outcome associated with the work setting. Satisfaction in the context of teamwork has been defined as the fulfillment of social needs and the willingness to say in the group (Hackman, 1987).

Developed in 1959, Herzberg's two-factor theory of job satisfaction continues to be highly influential (Herzberg & Maidani, 1991; Jewell, 2004). Herzberg, Mausmer, &

Snyderman (1959) identified factors that they believed were responsible for job satisfaction or job dissatisfaction. According to these authors, job satisfaction is associated with a construct labeled as intrinsic factors. Intrinsic factors focused on the motivators that facilitate individual growth and striving for self-actualization. Intrinsic factors include achievement, recognition, work itself, responsibility, advancement and salary. The second construct, context factors, are associated with the job setting. Context factors include company policy and administration, supervision, salary, interpersonal relationships, working conditions, professional status, job security, and effect on personal life. The theory identified salary as being both an intrinsic factor and a context factor. Herzberg, and colleagues (1959) posited a hierarchical relationship between intrinsic factors and context factors, noting that intrinsic factors rest on the foundation of context factors because individuals who are striving for self actualization desire settings that permit realization of intrinsic factors.

Empirical support for the Two-factor Theory includes a study conducted in 1991 by Herzgberg and Maidani which compared job satisfaction among public and private sectors employees. The author's found that in both job sectors, satisfaction was associated with intrinsic factors. Work roles that offered individuals responsibility and autonomy were more likely to be associated with job satisfaction regardless of the job sector.

Herzgberg and Maidani's (1991) finding is consistent with studies of job satisfaction among members of healthcare teams. Perceived autonomy has been identified as a key predictor of job satisfaction. Perceived autonomy refers to the

freedom and responsibility for making decisions relative to the job tasks for which the individual or team has responsibility (Lichtenstein, et al., 2004; Molleman, Nauta, & Jehn, 2004). Barry and Stewart (1997) posit that when team task autonomy is high, individual team members have many opportunities to grow into different roles and to shape their own work.

Personality. There are numerous conceptualizations of personality dimensions and to add further confusion, different names are given to dimensions that are conceptually similar (Hogan, Raza, & Driskell, 1988). A major advancement in personality research is the identification of the Five Factor Model of Personality (McCrae & Costa, 1999, 2004). The Five Factor Model seems to provide a unifying framework for examining personality in research and personnel selection. The following labels have typically been used: (1) Surgency or Extraversion, (2) Agreeableness, (3) Conscientiousness, (4) Emotional stability, and (5) Openness to experience (Hogan, Hogan, et al., 1996).

Research examining the affect of personality factors in a team setting is limited. However, personality may be an important consideration for team interaction. Thoms and Moore (1996) examined the relationship between the Five Factor Model of Personality and self-efficacy for participating in teamwork. They found that conscientiousness, extraversion, agreeableness, and emotional stability are significantly related to self-efficacy for teamwork and that conscientiousness has the highest correlation with teamwork self-efficacy.

Another study found that extraversion was significantly related to socio-emotional input to the team's interaction. Socio-emotional input was operationalized as communication style, leader style, and problem resolution (Barry & Stewart, 1997). Further, Barrick and Mount (1991) found that extraversion was a valid predictor of performance for jobs involving social interaction. Costa and McCrae (1992) identified extraverts as being predisposed to being outgoing, confident, assertive, and talkative. They posit that an agreeable person is altruistic, sympathetic, and is eager to help others. From this perspective, extraverts may be more motivated to engage in important team process behaviors than are introverts. Extraverts may be more likely to communicate freely with other team members without the fear of intimidation, seek and provide feedback, motivate other team members, and work with others to solve problems.

Model Summary

The Model of I-LTC (Figure 1) presented in this chapter indicates that team interaction can be explained by predisposing factors, knowledge of group development, dynamics and process, leadership communication skills, and technical/professional abilities. The conceptual model of the Team Skills Scale (TSS) was derived from the Model of I-LTC and is depicted in Figure 2.

Existing empirical evidence for individual-level team competencies is scant and ambiguous. Some of the ambiguity is a result of the lack of a common language for teamwork concepts. For example, the only difference between the terms interpersonal skills and small group communication skills seems to be the number of people involved in the interaction. Often, these two constructs are operationalized in the same way.

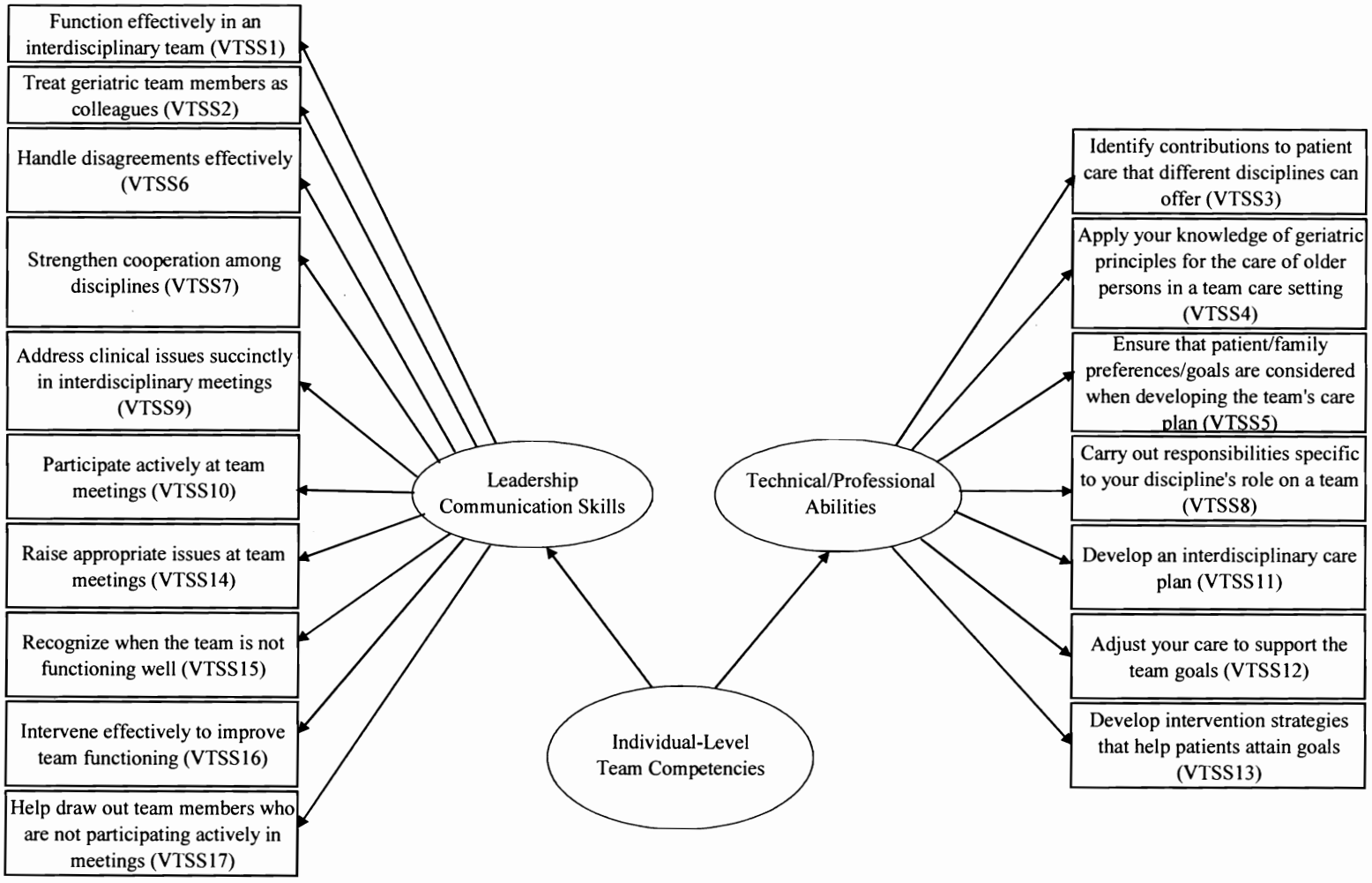


Figure 2: Team Skills Scale Conceptual Model

Research Hypotheses

The following research hypotheses are stated for empirical verification. These hypotheses guide the inquiry about the factorial validity of the TSS.

Hypothesis 1: The Team Skills Scale (TSS) is a first-order two-factor structure (leadership communication skills and technical/professional abilities).

Hypothesis 2: Performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples.

Hypothesis 3: Student trainee age, attitude about the physician as team leader and sole patient care decision-maker, and attitude about the quality of patient care that is delivered by teams are predictors of self-perceived team skills as measured by the plausible TSS measurement model.

Chapter Summary

The emerging 21st Century healthcare system is placing emphasis on the need for interdisciplinary education and team training so that healthcare professionals can better address the complex needs of geriatric and underserved populations. Health professions schools are being encouraged by industry leaders, such as the PEW Commission on the Health Professions, The John A. Hartford Foundation, the Association of Academic Health Centers, and their individual accrediting bodies to meet the challenge of preparing students for interdisciplinary teamwork; noting that interdisciplinary teamwork is an individual skill that all healthcare professionals must acquire.

While the literature contains many accounts of interdisciplinary team curricula content and team training program evaluations, the relationships between individual-level

teamwork competencies, team interaction and team effectiveness have remained largely unexplored. Three research hypotheses were proposed and were investigated in the subsequent chapters. The measurement model of the TSS proposed in this chapter formed the basis for assessing the Scale's factorial validity. The TSS is potentially a one-of-a-kind self-assessment questionnaire that captures a trainee's perception of her/his geriatric interdisciplinary team skills. There is substantial evidence that task specific self-perception of what one can do is a predictor of actual performance. Additionally, positive self-perceptions have been linked to persistence with desirable behavior changes. Thus, the TSS has potential use as a competency-based educational tool for evaluating the extent to which learners have acquired teamwork skills. A description of the data and the analytic plan for testing research hypotheses are presented in Chapter 3.

CHAPTER 3: METHODS

The purpose of this study is to assess the factorial validity of the Team Skills Scale (TSS). Additionally, the TSS will be evaluated for factorial invariance across the three types of Geriatric Interdisciplinary Team Training (GITT) program models.

Chapter Three describes prior psychometric testing of the TSS, the study design, the data source, and study variables. Then, a brief explanation of structural equation modeling (SEM) is provided. Finally, the statistical plan for examining the factorial validity of the TSS and testing study hypotheses is presented.

Institutional Review Board Approval

An application for exemption from the requirements set forth in Regulations for the Protection of Human Subjects (Title 45 Part 46 of the *Code of Federal Regulations*) was submitted to the Virginia Commonwealth University (VCU) Institutional Review Board (IRB) and was approved (VCU IRB # 6013) on August 5, 2005. This study was approved for exemption because it met the criteria as specified in Exemption Category 4 "Research involving the study of existing data recorded by the original investigators in such a manner that subjects cannot be identified directly or through identifiers linked to the subjects." A copy of the approval letter is at Appendix A

Team Skills Scale Instrument and Prior Psychometric Testing

The TSS is a 17-item instrument structured on a 5-point Likert-type scale with values ranging from 1 "poor" to 5 "excellent"; summing the 17 items results in a score

with a value between 17 and 85. High scores are associated with positive perceptions of capabilities for effective team interactions. The TSS is purported to measure three factors: interpersonal skills, discipline-specific skills, and geriatric care skills (Hyer, et al., 2002). However, there are no subscales nor does the recommended item scoring account for the three factors purported to be measured. The 17 items along with the coding algorithm used for this study are shown in Table 4.

As of March 2005, there had been only one published account of the psychometric properties of the TSS. Using GITT data, Hyer, and colleagues (2002) reported results of their exploratory factor analysis (EFA) with orthogonal (varimax) rotation. They found that all 17 items loaded on one factor, explaining 53% of the Scale's variance. These results suggest that the three factors lack discriminate validity, or that the 17 items measure only one construct (unidimensional scale). Intuitively, it seems more likely that the TSS is multidimensional (measures more than one construct).

Hyer, and colleagues (2002) also reported two measures of the Scale's internal consistency. First, a value of .94 for Cronbach's Coefficient Alpha suggests that TSS items are interchangeable indicators of the same underlying latent factor. Specifically, high internal consistency indicates that all TSS items are measuring the same attribute. High internal consistency between all TSS items, when it is purported to measure three factors is not a favorable scale trait (DeVellis, 1991). However, an important consideration is that Cronbach's Coefficient Alpha is not robust to outlying observations and could result in an inflated Alpha value (Christmann & Van Aelst, 2003).

Table 4

Team Skills Scale Items and the Coding Algorithm for Pretest/Posttest Variables

Please rate your ability to carry out each of the following tasks at this point in your training using a five-point scale.

Poor=1	Fair=2	Good=3	Very Good=4	Excellent=5

Indicators	Pretest Variable
1. Function effectively in an interdisciplinary team	VTSS1
2. Treat geriatric team members as colleagues	VTSS2
3. Identify contributions to patient care that different disciplines can offer	VTSS3
4. Apply your knowledge of geriatric principles for the care of older persons in a team care setting	VTSS4
5. Ensure that patient/family preferences/goals are considered when developing the team's care plan	VTSS5
6. Handle disagreements effectively	VTSS6
7. Strengthen cooperation among disciplines	VTSS7
8. Carry out responsibilities specific to your discipline's role on a team	VTSS8
9. Address clinical issues succinctly in interdisciplinary meetings	VTSS9
10. Participate actively at team meetings	VTSS10
11. Develop an interdisciplinary care plan	VTSS11
12. Adjust your care to support the team goals	VTSS12
13. Develop intervention strategies that help patients attain goals	VTSS13
14. Raise appropriate issues at team meetings	VTSS14
15. Recognize when the team is not functioning well	VTSS15
16. Intervene effectively to improve team functioning	VTSS16
17. Help draw out team members who are not participating actively in meetings	VTSS17

Item-total score correlations, ranging from .58 to .78, were the second measure of internal consistency that was reported. Usually, item-total score correlations that are less than .71 are items that may not belong to same factor (Wan, 1995). This suggests that items with a correlation value less than .71 are measuring a factor that is different from the factor measured by items with a correlation value greater than or equal to .71.

It appears that the two measures of internal consistency suggest different conclusions. While Cronbach's Coefficient Alpha suggests a unidimensional scale measuring interchangeable indicators, the item-total score correlations suggests that the TSS is measuring more than one factor or that some TSS items should be discarded. No other information was available about the decisions that the researchers made in selecting from the various options that influence EFA or Cronbach's Coefficient Alpha.

Design

This nonexperimental study used secondary data that were collected for the GITT program evaluation to assess the factorial validity of the TSS. Factorial validity (Byrne, 2001) is a form of construct validity that examines the factor structure of an instrument and answers the question: "Is the factor structure valid?"

Validity of the TSS was evaluated based on this author's conceptualization of individual-level competencies required for effective team interaction. The TSS purportedly provides information about the individual's self-perceived team skills. The TSS can be thought of in terms of skills that individuals bring to the team process; in turn, these individual-level skills contribute to team interaction and ultimately, team effectiveness.

Confirmatory factor analysis (CFA) was performed to estimate how well the observed variables represent a first order model with two-factors. The goals were to: 1) validate the TSS measurement model; 2) test the plausible measurement model for factorial invariance; and 3) evaluate the applicability of the plausible model for predicting variation in perceived team skills (covariance structural model).

The Data

The data for this study were provided by The New York University Geriatric Interdisciplinary Team Training Resource Center and were collected as part of the evaluation of the GITT program. The data file that this researcher received from the GITT Resource Center contained 1,715 cases. The data file that was provided for this study does not contain personal identifiers nor are the data coded for the purpose of identifying individuals. Data elements include trainee demographics, TSS data and a number of other data elements from instruments that were used as part of the program evaluation of the eight GITT projects. The pretest/posttest data include responses from student trainees, preceptor trainees, and preceptors who were not trainees and were collected between January 1997 and June 2000. Trainees were administered the same instruments just before the GITT intervention and again following the intervention. Only variables pertinent to the present study will be selected and used.

Sample Description and Selection

For purposes of this study, only student trainee data were used. A student trainee is defined as a physician, nurse, social worker, pharmacist, or allied health student enrolled in a graduate education program at the time of the GITT training intervention

(The GITT Program Faculty, 1999). Preceptors are experienced healthcare practitioners who serve as clinical role models and resource persons for student trainees (Kelly-Thomas, 1998). Preceptor and preceptor trainee data are not included in this study because these practitioners had more knowledge and experience with interdisciplinary healthcare teams than did student trainees. This knowledge and experience makes preceptors and preceptor trainees different from student trainees, and use of these data would add a source of random bias to the analyses (Trochim, 2001). Student trainees completed pretest and posttest TSS measures between January 1997 and June 2000. The pre-screened data for this study contains 1,341 student trainees.

Data Accuracy

Each of the eight GITT sites had an on-site program evaluator and a data collection assistant who administered the core measures at the beginning and end of training. All instruments were mailed to the GITT Resource Center following each collection effort. All data entry and cleaning were performed at the GITT Resource Center (The GITT Program Faculty, 1999).

Pre-Analysis Data Screening

Data screening and descriptive analyses were performed using SPSS, version 13.01. Data quality assurance checks were performed to confirm that data values were within the expected range. Then, checks were performed to identify cases with incomplete data or missing values. Any identifiable patterns of missing data were documented. Tabachnick and Fidell (1996) noted that missing values that are associated with a nonrandom pattern pose a problem for generalizing results of data analysis.

However, an advantage of structural modeling is that the missing data mechanism can be included in the model (Byrne, 2001).

For this study, cases with missing values were excluded from analyses. Next, the data were also screened for univariate and multivariate outliers. All statistical tests that rely on squared deviations from the mean (most multivariate analyses) will have distorted results if outliers are not detected and managed by either (1) removing the cases from the analyses, or (2) performing data transformations. In this study, multivariate outliers were excluded from the analysis. Descriptive statistics were produced for pre-screened and post-screened student trainees demographic variables and TSS variables. Finally, the data were screened to assess the adequacy of fit between the data and the assumptions for each statistical procedure (Tabachnick & Fidell, 1996). Mulitivariate assumptions are summarized in Table 5.

Introduction to Structural Equation Modeling

Structural Equation Modeling (SEM) provides information about causal relationships among observed variables and latent factors and specifies how much variance remains unexplained by the model. SEM allows the researcher to account a priori for measurement errors that are due to imperfect specification (Byrne, 2001; Polit & Hungler, 1999; Ullman, 1996; Wan, 2002). Further, SEM models enable researchers to study both the direct and indirect effects of the variables included in a model. Direct effects are those that go directly from one variable to a second variable. Indirect effects means that at least one mediating variable comes between two other variables.

Table 5

Data Screening for Multivariate Statistics Assumptions

Assumption	Assumption Testing Method
Univariate and Multivariate Normality	Examination of skewness, kurtosis, normal probability plots, and Bivariate scatterplots
Multivariate Outliers	Mahalanobis distance
Linearity	Bivariate scatterplots
Multicollinearity and Singularity	SPSS collinearity diagnostics procedures; note: SEM allows for interpretation even in the face of multicollinearity
SEM Residual covariances	Use SEM fit statistics
Sample Size	Factor-analytic procedures require large samples. Too few subjects per parameter may produce Type I error.
Interval data are assumed	However, SEM explicitly models error, including error arising from use of ordinal data.

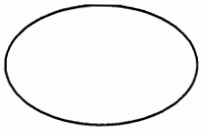
Schematically, SEM models are depicted using geometric symbols and arrows as shown in Table 6. Observed variables are the variables that are actually measured and are presented by rectangles/squares. Observed variables have actual data that has been collected to measure the variables (i.e. TSS items). A factor is a hypothetical variable that influences scores on one or more observed variables. Factors are usually described as latent, unobserved and not directly measured. Latent factors are operationalized by observable variables believed to represent them. Once operationalized, latent factors can be measured (Ullman, 1996; Wan, 2002). For example, leadership communication skills and technical/professional abilities are latent factors that are operationalized by TSS variables.

Observed variables and latent factors can be either exogenous or endogenous. Exogenous variables are those for which the model makes no attempt to explain because they are not caused by other model variables. For example, the latent factor "individual-level team competencies" is an exogenous variable. When presented as a path model, exogenous variables do not have arrow-headed lines pointed toward them. On the other hand, endogenous variables are those for which the model attempts to explain and have a least one single-headed arrow pointed toward them when presented as a path model. Endogenous variables can be either observed and/or latent (Wan, 2002).

The relationships between observed variables and latent factors are represented graphically by one-way and two-way arrows. The one-way arrows symbolize causal relationships. The variable at the tip of the arrow head is assumed to be the effect and the

Table 6

Symbols and Terms used in Structural Equation Models

Symbols	Associated Measurement Terms
Observed variable(s)  An observed variable is one for which scores have been collected.	X = an observed variable that defines an exogenous latent factors (ξ) λ = gamma, denotes the relationship between X and ξ d = delta, an error term for an observed variable that defines an exogenous latent factor Y = an observed variable that defines an endogenous latent factor (η) γ = lambda, denotes the relationship between Y and η e = epsilon, an error term for an observed variable that defines a latent endogenous factor (η)
Latent factor(s)  A latent factor is one whose existence is not directly observable but inferred on the basis of observed variables	ξ = xi, an exogenous latent factor Γ = gamma, relates exogenous to endogenous construct or variable η = eta, an endogenous latent factor B = beta, relates endogenous factors to one another z = zeta, an error term for an endogenous latent factor

variable at other end of the arrow is assumed to be the cause. Two-way arrows are used to show that there is an association between two variables (covariation). Absence of an arrow connecting variables implies no hypothesized direct effect (Wan, 2002).

Two components are included in SEM analysis: a measurement model and a structural model. The measurement model defines relationships between observed variables and unobserved hypothetical factors. In this study, the measurement model was used to assess the link between TSS item scores and the two underlying theoretical endogenous factors they were designed to measure (leadership communication skills and technical/professional abilities). Thus, the measurement model specifies the pattern by which each TSS item loads onto a specific latent factor and provides information about the strength of the regression paths from latent factors to observed variables.

The second component, the structural model, defines the relationships between the latent theoretical factors themselves. The structural model specifies the manner by which the latent factors directly or indirectly cause changes in the values of other latent factors in the model (Maruyama, 1998). In other words, the direct relationships between individual-level team competencies, leadership communication skills and technical/professional abilities are assessed.

Analytical Methods

Model Parameters

In SEM, parameters are unknown aspects about the distribution of the variables considered in a model. Specifically, parameters are the aspects of the model to be estimated during the model fitting process (Tabachnick & Fidell, 1996). Parameters can

be free, fixed or constrained. A parameter is free if it was determined based on one of the six rules for determining model parameters and the researcher has not imposed a constraint (Bentler, 1995). For example, all parameters that do not have a fixed value of 1 are free parameters. A parameter is fixed if its value is set to a given constant; thus, its value does not change when the model is fit to the observed data. For example, in the initial measurement model all parameters assigned values of "1" are fixed parameters. The third type of model parameters is theory driven. Parameters that are hypothesized to be equal to one another but the value is not assigned a priori are called constrained. Because SEM analysis can be conducted in a number of ways with regard to a set of parameters, it is important to explicitly define model parameters. This process will add to the likelihood that the model being fitted is correctly specified.

Figure 3 shows the structure as proposed by hypothesis 1. The initial CFA measurement model is composed of two latent exogenous factors, leadership communication skills and technical/professional abilities. Additionally, there are 17 observed endogenous variables; ten of which are believed to measure leadership communication skills factor and the other seven TSS items are believed to measure the technical/professional abilities factor. Because they are unobserved, latent factors have no definite metric scale. However, in order for the model to be "identified" every latent factor must have its scale determined. This is accomplished by constraining one factor loading for each of the two latent factors to a value of one. The factor loading that is fixed to a value of 1 is called a reference variable. Thus, as depicted in Figure 3, VTSS1 is the reference variable for leadership communication and VTSS8 is the reference

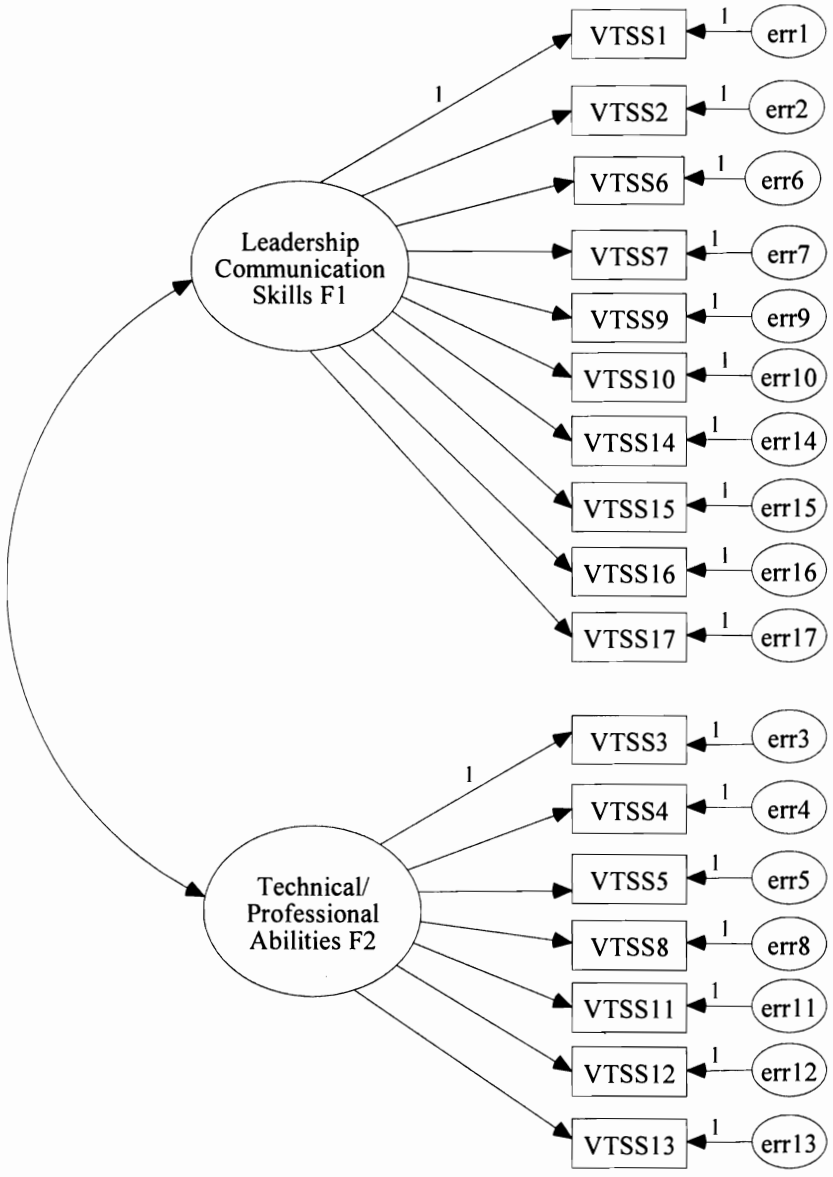


Figure 3: Initial CFA Measurement Model of the TSS

Note. The number 1 associated with a factor loading represents a model constraint.

variable for technical/professional abilities. The model also depicts 17 error terms, one associated with each TSS item. In total, there are 36 parameters in the model depicted in Figure 3, above. Of the 36 parameters, 34 will be estimated. There are two TSS factors as indicated by the two ellipses and the two factors are intercorrelated as indicated by the two-headed arrows. There are 17 observed variables, as indicated by the 17 rectangles showing that each observed variable loads on one and only one factor. Fifteen of the 17 observed variables will be estimated (the other two are fixed to a value of 1). There are 17 errors of measurement associated with each observed variable.

Subject-to-Variable Ratio

It was expected that the subject-to-variable (STV) ratio would be more than adequate to produce reliable results. The STV ratio should be a minimum of five to ten subjects (cases) for each parameter included in the analysis. Tabachnick and Fidell (1996) recommend a minimum of 200 cases for small (10 or fewer parameters) to medium (11 to 20 parameters) sized SEM models. Given that the prescreened TSS data includes 1,341 student trainees, the post screened data was anticipated to have an acceptable STV ration.

Analysis Plan

The factorial validity of the TSS, measurement invariance and structural equation modeling, was performed using the Analysis of Moment Structures (Amos 4.0) software program (Arbuckle & Wothke, 1999; Byrne 2001). First, CFA maximum likelihood (ML) method was used to evaluate the factor structure of the TSS. There are two main advantages of the ML method. First, the ML method is robust to minor deviations from

normality (Jöreskog & Sörbom, 1993). Second, the ML method determines estimates for model parameters that maximize the likelihood of obtaining the same structure if one were to collect data from the same population again (Tabachnik & Fidell, 1996).

Goodness-of-fit statistics were used to determine if the pattern of variances and covariances in the data were consistent with the proposed two-factor measurement model. There are many goodness-of-fit statistics. Fit statistics used for this study are specified in Table 7 and include Chi-square, the regression weight critical R, standardized regression weights, covariances error estimates, standardized squared multiple correlations, modification indices, goodness-of-fit index, root mean square error, and Hoelter's critical N. Correlation among error terms for TSS items denotes that Scale items do not fully operationalize the associated latent endogenous factor.

Second, after performing confirmatory factor analysis and revising, as needed, the plausible measurement model were evaluated for invariance (cross-validated). Specifically, the data were randomly divided into two samples and the invariance of the plausible model was assessed. Consistency of the measurement model across sample groups is an indicator that TSS items perform equivalently across samples and that the proposed measurement model is a valid theoretical structure.

Third, a covariance structure model was analyzed. This model assessed the effects of trainee age and attitude variables on team skills self-efficacy as measured by the validated TSS.

Table 7

SEM Model Evaluation Criteria

Statistic	Desired Fit Value
Chi-square – is used in SEM to examine the plausibility of model parameter restrictions such as equality of factor loadings, factor or error variances, or factor variances and covariances across groups	Nonsignificant
Regression Weights "Critical R"	> 1.96
Standardized Regression Weights "Lambdas"	≥ 0.05
Covariances error estimates	No negative values
Standardized squared multiple correlations – Variance explained	1.0 is the maximum value
Modification indices (M.I.) – identifies possible model improvements	Delete values > 100
Regression weights modification indices – identifies potential model improvement, if consistent with theoretical framework	Delete values > 100
Goodness-of-fit index (GFI) – error in reproducing the variance-covariance matrix	≥ 0.90
Root mean square error – identifies how well the estimate is a match to the population	< .05
Hoelter's critical N - the size the sample size must reach for the model acceptance	≥ 200

Hypotheses

Hypothesis 1: The Team Skills Scale (TSS) is a first-order two-factor structure (leadership communication skills and technical/professional abilities).

Hypothesis 2: Performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples.

Hypothesis 3: Student trainee age, attitude about the physician as team leader and sole patient care decision-maker, and attitude about the quality of patient care that is delivered by teams are predictors of self-perceived team skills as measured by the plausible TSS measurement model.

The factor structure specified by Hypothesis 1 was shown earlier in Figure 3. There are two first-order latent exogenous factors. The two first-order latent exogenous factors are assumed to be correlated. Each first-order latent factor is measured by a number of observed variables (VTSS series) and each observed variable is assumed to reflect its underlying factor. Each observed variable loads only on one latent factor. The two latent exogenous factors are assumed to cause the variation and covariation between observed variables.

The extent to which these measured items actually tap into the underlying factor was determined by estimating the respective path loadings. The model indicates that there may be a certain amount of measurement error reflected in each observed variable. It is not assumed that the latent factors completely explain the observed variation; therefore, one residual term is associated with each first-order latent factor. The

variances for each unique factor were fixed to one. Finally, a regression weight of 1 was assigned to "Function effectively in an interdisciplinary team" (VTSS1) which loads on leadership communication skills and "Carry out responsibilities specific to your discipline's role on a team" (VTSS8) which loads on technical/professional abilities because these loading are necessary to give the latent factors an interpretable scale. Specifically, the loadings standardize the scale of the latent factor to a Z-score.

After performing confirmatory factor analysis and revising (if needed), the plausible measurement model was used to evaluate model invariance (Hypothesis 2). If the model performed equivalently across the two random samples of GITT data; then, there is more evidence to support the plausibility of measurement model. Testing for measurement invariance involves the original unconstrained model compared to a model where the data are randomly divided into two samples that are constrained to be equal. If the chi-square difference statistic does not reveal a significant difference between the original and the constrained-equal models, then it can be concluded that the model has measurement invariance (equality) across the two random samples.

In Amos equality constraints are applied by assigning regression weights. Each path gets a unique label. Labels are applied across all GITT sites. The paths connecting latent factors are labeled, but latent observed indicator paths are not labeled.

Mathematical Notation

In addition to the pictorial presentation of SEM models, a series of regression equations can be used to specify the influence of each variable on other model variables. In Figure 3, there are 17 observed variables with single-headed arrows pointing toward

them and two unobserved variables (leadership communication skills and technical/professional abilities). Additionally, error and residual terms are identified. The regression functions symbolized in the model can be summarized in terms of 17 separate representations of linear dependencies as noted in Table 8.

The Generic SEM Equations

Wan (2002) stated that "CFA attempts to explain the variation and covariation in a set of observed variables in terms of a set of theoretical, unobserved factors" (p.89). The general measurement model can be represented by two matrix equations. The mathematical notation for the basic CFA factor equations as noted by Wan (2002) are specified below in Equations 3.18 and 3.19. Equation 3.18 represents a generic CFA model that is used when observed exogenous variables are associated with a latent exogenous factor. In Equation 3.18, X is a vector of the observed variables; Λ_x (lamba) is a matrix of factor loadings relating the observed variables, ξ (ksi) is the exogenous factor and δ (delta) is a vector of residuals for the observed exogenous variable.

Equation 3.19 represents a generic CFA Model that is used when observed endogenous variables are associated with a latent endogenous factor. Eta (η) is a vector of latent endogenous factors and ε (epsilon) is a vector of residuals for the observed variables.

The structural model as shown in Equation 3.20 is composed of one latent endogenous factor (η, Eta), and Beta (β) represents the regression of one endogenous construct on another endogenous construct. In this equation, Gamma (γ) represents regression relations between latent constructs and the structural error term (ζ) zeta. The

Table 8

Regression Functions for the 17-item Team Skills Scale

LCS = ILTC + resid1		TPA = ILTC + resid2	
VTSS1 = LCS + err1	Equation 3.1	VTSS3 = TPA + err3	Equation 3.11
VTSS2 = LCS + err2	Equation 3.2	VTSS4 = TPA + err4	Equation 3.12
VTSS6 = LCS + err6	Equation 3.3	VTSS5 = TPA + err5	Equation 3.13
VTSS9 = LCS + err9	Equation 3.5	VTSS11 = TPA + err11	Equation 3.15
VTSS10 = LCS + err10	Equation 3.6	VTSS12= TPA + err12	Equation 3.16
VTSS14 = LCS + err14	Equation 3.7	VTSS13 = TPA + err13	Equation 3.17
VTSS15 = LCS + err15	Equation 3.8		
VTSS16 = LCS + err16	Equation 3.9		
VTSS17 = LCS + err17	Equation 3.10		

$$X = \Lambda_x \xi + \delta_x \qquad \text{Equation 3.18}$$

$$Y = \Lambda_y \eta + \varepsilon \qquad \text{Equation 3.19}$$

$$\eta = \beta\eta + \gamma\xi + \zeta \qquad \text{Equation 3.20}$$

structural model provides parameter estimates simultaneously for the measurement model and for the structural equation model.

Chapter Summary

The foundation for the statistical analysis used to test the factorial validity of Team Skills Scale was presented in this chapter. The Scale measures trainee self-perceptions of their capabilities for effective team interactions using a 17-item instrument with a five-point Likert-type response scale.

Data used to test for factorial validity were originally collected as part of a program evaluation of the effects of the GITT training intervention. The GITT program was a non-experimental single group pretest/posttest design. GITT data used in the current study were provided by The New York University Geriatric Interdisciplinary Team Training Resource Center and represent the eight GITT program sites that together trained 1,341 graduate level health professions students.

An overview of SEM was presented. Then, the analysis plan for the current study was described. Specifically, a first-order CFA model with two latent factors was specified to assess how well the 17 observed TSS items work as a measurement instrument.

CHAPTER 4: RESULTS

Chapter 4 presents statistical analysis results. In order of presentation, this chapter consists of a description of the prescreened data, explanation of the data screening process along with a description of the post screened data, and hypothesis testing results. Confirmatory Factor Analysis (CFA) was used to evaluate study hypotheses. Specifically, in this study, CFA was used to examine the factor structure of the Team Skills Scale (TSS).

Description of the Prescreened Data

Table 9 shows that a total of 1,715 healthcare professionals received GITT training and of that total, 1,341 (78.2%) were classified as student trainees. As discussed in Chapter 3, only student trainees were used for the current study. A student trainee is defined as a physician, nurse, social worker, pharmacist, or allied health professional enrolled in a graduate education program at the time of the GITT training intervention (The GITT Program Faculty, 1999).

As discussed in Chapter 2, each of the eight GITT sites can be classified into one of three intervention models for teaching geriatric interdisciplinary team care: Academic, Clinical or Mixed model. In the Academic Model, geriatric teaming courses were taught for credit within a university system by faculty from schools of medicine, nursing, social work, and other targeted disciplines. The Clinical Model involved presentation of geriatric team training in clinical settings. The Mixed Model combined aspects of both

Table 9

Number and Percent of GITT Participants by Trainee Status and GITT Model Type - Prescreened Data

GITT Participants	GITT Model Type				
	Academic	Clinical	Mixed	Total	Percent
Student Trainee	572	272	497	1,341	78.2%
Staff/Preceptor Trainee	5	160	0	165	9.6%
Preceptor -- not a trainee	92	41	76	209	12.2%
Total	669	473	573	1,715	
Percent	39.0%	27.6%	33.4%		

Academic and Clinical models (GITT Implementation Manual, 2001).

Table 10 shows that the majority (42.7%, $n = 572$) of student trainees were trained based on the Academic Model followed by the Mixed Model (37.1%, $n = 497$) and a little more than 20% ($n = 272$) were trained under the Clinical Model. The Houston GITT program, Academic Model, trained the largest percentage of student trainees (26.9%, $n = 361$).

In terms of demographic characteristics, Table 11 shows that 82.2% ($n = 1,046$) of student trainees were less than 40 years old, the mean age was 32.7 years with a standard deviation of 7.7 years. As shown in Table 12, approximately 71% ($n = 913$) of student trainees were female. The race/ethnic origin is presented in Table 13. Most student trainees were Caucasians 69% ($n = 889$), followed by Asian/Pacific Islander (19.9%, $n = 217$). A little more than 6% ($n = 79$) of student trainees were African American and trainees of Hispanic descent comprised 5.6% ($n = 72$) of the prescreened data.

The number and percent of student trainees by academic discipline is presented in Table 14. The largest single discipline among student trainees was medical resident (41%, $n = 551$) followed by graduate level nursing students (16.4%, $n = 220$). Together, these two groups accounted for almost three-fifths (57.5%, $n = 771$) of all student trainees. A little more than 11% of trainees were graduate level social work students, almost 7% were pharmacy students and the remaining 21.8% of students were seeking master's degrees in allied health professions such as Occupational Therapy, Physical Therapy and Health Administration.

Table 10

Total Number of GITT Participants by Project Site and Model Type

Project Site	Program Model					
	Academic		Clinical		Mixed	
	Prescreened	Screened	Prescreened	Screened	Prescreened	Screened
Great Lakes			n=84	n=76		
Houston	n=361	n=300				
Mt. Sinai					n=123	n=103
On Lok			n=188	n=177		
Rush					n=195	n=177
Colorado					n=179	n=159
Minnesota	n=135	n=121				
South Florida	n=76	n=67				
Total Number and Percent by Model Type	n=572 (42.7%)	n=488 (41.4%)	n=272 (20.3%)	n=253 (21.4%)	n=497 (37.1%)	n=439 (37.2%)

Note. Chi-square statistic indicated no significant difference between prescreened and screened data; p = .719

Table 11

Number, Percent, Mean and Standard Deviation of Student Trainees by Age Category

Age Category	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
Age 20 - 29.9	586	46.0%	534	44.0%
Age 30 - 39.9	460	36.1%	410	33.8%
Age 40 - 49.9	171	13.4%	150	12.4%
Age 50 - 59.9	50	3.9%	42	3.5%
Age 60 - 69.9	5	0.4%	4	0.3%
Age 70 - 79.9	1	0.1%	1	0.1%
Age not recorded	68		39	3.2%
Total cases	1,341		1,180	
Total valid cases	1,273		1,141	
Age less than 40 years	1,046	82.2%	944	75.3%
Age 40 or older	227	17.8%	197	15.7%
Mean	32.7 years		32.5 years	
Standard Deviation	7.7 years		7.6 years	

Note. One-way ANOVA results indicate no significant difference between mean prescreened and screened data, $p = .655$.

Table 12

Number and Valid Percent of Student Trainees by Gender

Gender	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
Female	913	70.5%	810	69.8%
Male	382	29.5%	350	30.2%
Gender not recorded	46		20	
Total cases	1,341		1,180	
Total valid cases	1,295		1,160	

Note. One-way ANOVA results indicate no significant difference between prescreened and screened data; $p = .716$.

Table 13

Number and Valid Percent of Student Trainees by Race/Ethnic Origin

Race/Ethnic Origin	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
African American, not Hispanic	79	6.1%	62	5.4%
Asian/Pacific Islander	217	16.9%	202	17.5%
Black/Non African American	9	0.7%	8	0.7%
Caucasian, not Hispanic	889	69.1%	796	69.1%
Native American/Alaskan Islander	3	0.2%	3	0.3%
OTHER, Hispanic	72	5.6%	63	5.5%
OTHER, not Hispanic	18	1.4%	18	1.6%
Race/Ethnicity not recorded	54		28	
Total cases	1,341		1,180	
Total valid cases	1,287		1,152	

Note. Chi-square statistic indicated no significant difference between prescreened and screened data; $p = .978$.

Table 14

Number and Percent of Student Trainees by Academic Discipline

Discipline	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
Medical	551	41.1%	497	42.6%
Nursing	220	16.4%	200	17.2%
Social Work	150	11.2%	132	11.3%
Pharmacy	88	6.6%	83	7.1%
Other	293	21.8%	254	21.8%
Total Valid Cases	1,302	97.1%	1,166	98.8%
not recorded	39	2.9%	14	1.2%

Note. Chi-square statistic indicated no significant difference between prescreened and screened data; $p = .989$.

The number and percent of student trainees by prior formal team training experience is shown in Table 15. A little more than three-fourths (n = 971) of student trainees reported no prior formal team training experiences. Approximately 55% (n = 532) of the 964 individuals who reported being employed said that they work in the field of geriatrics. However, as shown in Table 16, relatively few (32%, n = 170) of those employed in the field of geriatrics had five or more years of paid work experience.

Descriptive statistics for TSS pretest item total scores are presented in Table 17. Of the 1,341 student trainees, 1,293 individuals provided pretest TSS responses. When each TSS item has a response recorded, the minimum score possible is 17 and the maximum score is 85 for any given individual (Hepburn, et al., 1996; Hyer, et al., 2002). The median item total score for GITT student trainees was 38 and the mode was 33. The highest attained pretest score was 68, while the minimum attained score was 3. The attained minimum score indicates that at least one responder did not complete all 17 TSS items. Also, the Likert-type scale values ranged from 0 to 4 rather than ranging from 1 to 5 as intended by the Scale's authors. This issue is discussed in the data screening section.

Data Screening

Prior to analysis, all variables were examined for data entry accuracy, missing values, and fit between their distributions and for SEM assumptions. Data entry accuracy was assessed using univariate descriptive statistics to ensure that variable values were within the appropriate ranges and to assess the reasonableness of measures of central tendency and dispersion for each variable. As was noted earlier in Table 4, Mahalanobis

Table 15

Number and Percent of Student Trainees by Prior Formal Team Training Experience

	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
Yes	310	24.2%	278	24.2%
No	971	75.8%	869	75.8%
No Response recorded	60		33	
Total cases	1,341		1,180	
Total valid cases	1,281		1,147	

Note. One-way ANOVA results indicate no significant difference between prescreened and screened data; $p = .983$.

Table 16

Number and Valid Percent of Student Trainees by Years Worked for Pay in Geriatrics

	Prescreened		Screened	
	Number of Participants	Valid Percent	Number of Participants	Valid Percent
Employed less than two years	141	14.6%	129	15.0%
Employed two years or more but less than five years	221	22.9%	198	23.1%
Employed five years or more	170	17.6%	153	17.8%
Not Employed in Geriatrics	432	44.8%	379	44.1%
No Response recorded	377		321	
Total valid cases	964		859	
Mean / SD	2.52 / 4.25		2.51 / 4.20	

Note. One-way ANOVA results indicate no significant difference between mean prescreened and screened data; $p = .975$.

Table 17

Descriptive Statistics for Team Skills Scale Item Total Scores

	Prescreened Data		Screened Data	
Number of Cases		1,293		1,180
Missing		48		0
Mean		55.59		56.20
Median		55		56
Mode		61		61
Std. Deviation		11.46		11.34
Variance		131.41		128.53
Skewness		-0.069		-0.031
Kurtosis		0.010		-0.15
Minimum		12		20
Maximum		85		85
Percentiles	25	48	25	49
	50	55	50	56
	75	64	75	64

Notes. Likert values were recoded 1 to 5. The original values ranged from 0 to 4.

No significant difference between prescreened and screened means; $F(1, 2471) = 1.73$, $p = .188$ at the .05 level.

distance was used to identify multivariate outliers, bivariate scatterplots were used to assess multivariate normality and linearity and collinearity diagnostics procedures were used to assess multicollinearity and singularity. SEM residual covariances were assessed using SEM fit statistics.

Accuracy of Data Entry

One data coding problem was identified. The TSS items should have been coded 1 for poor, 2 for fair, 3 for good, 4 for very good and 5 for excellent (Hepburn, et al., 1996; Hyer, et al., 2002). Instead, the scale was formatted 0 to 4. Therefore, the data were recoded to match the format as specified by the authors of the TSS. This was accomplished using the SPSS recode procedure. All values of zero were recoded to a value of one; values of two were recoded to a value of three and so on.

Missing Data

Table 18 presents the frequency of missing responses for prescreened TSS Items. Of the 1,341 student trainees, 3.6% (n = 48) did not complete any of the 17 TSS pretest items. These cases were deleted from the analysis file; the identification numbers for these cases are listed in Appendix B (Table 31). Of the remaining 1,293 cases, another 6.5% (n = 73) has at least one missing response among the 17 TSS items. Although Amos 4.0 can compute full maximum likelihood estimates in the presence of missing data, modification indices are not computed when there are variables with missing values (Arbuckle & Wothke, 1999). Because modification indices are used to identify possible model improvements, cases with missing responses for one or more TSS items were deleted. "Intervene to improve team functioning" (VTSS16) is the item with the largest

Table 18

Frequency of Missing Responses for Each Team Skills Scale Item – Prescreened Data

Item Label	Item Name	Number of Missing Responses
VTSS16	Intervene to improve team functioning	24
VTSS15	Recognize when team is not functioning well	18
VTSS17	Draw out team members who do not participate actively	17
VTSS2	Treat team members as colleagues	16
VTSS12	Adjust your care to support the team goals	11
VTSS14	Raise appropriate issues at team meetings	11
VTSS8	Carry out responsibilities specific to discipline's role	9
VTSS4	Apply knowledge of geriatric principles …	7
VTSS10	Participate actively at team meetings	7
VTSS3	Identify contributions to patient care	6
VTSS11	Develop an interdisciplinary care plan	6
VTSS13	Develop intervention strategies	6
VTSS 9	Address clinical issues succinctly	5
VTSS1	Function effectively in teams	4
VTSS5	Ensure patient/family goals are considered	4
VTSS7	Strengthen cooperation among disciplines	3
VTSS6	Handle disagreements effectively	2

number of missing responses ($n = 24$) followed by 18 missing responses for "Recognize when the team is not functioning well" (VTSS15), and 17 missing responses for "Help draw out team members who are not participating actively in meetings" (VTSS17). After deleting the 73 cases with missing values, 1,220 cases remained for further analysis.

Outliers

Based on item values for skewness and Kurtosis, no univariate outliers were detected. Mahalanobis Distance was computed to identify multivariate outliers. Mahalanobis Distance is evaluated as Chi-square (X^2) times the number of TSS items ($X^2(17), p < .001$). For TSS data, any case with a Mahalanohis Distance greater than or equal to 40.79 is considered to be a multivariate outlier. Forty cases were identified as multivariate outliers. Further analysis was conducted in an attempt to determine why these cases were multivariate outliers and the potential impact on generalizability of study results. No clear demographic patterns could be identified. Additionally, none of the 17 TSS items was a consistent outlier across a majority of cases. All 40 multivariate outliers were deleted leaving 1,180 cases for further analyses (See Appendix B Table 32 for case identification numbers for the 40 deleted multivariate outliers).

Description of the Screened Data

There was high consistency between the prescreened and screened data. Returning to Table 10, as with the prescreened data, the majority of student trainees were trained based on the Academic Model (41.4%, $n = 488$) followed by the Mixed Model (37.2%, $n = 439$) and a little more than 21% ($n = 253$) were trained based on the Clinical Model. The Houston GITT program, Academic Model, trained the largest percentage of

student trainees (25.9%, $n = 300$). Chi-square statistic indicated that there was no significant difference between the prescreened and screened data by project site; $p = .719$.

Demographically, 75.3% ($n = 944$) of the student trainees were less than 40 years old and the mean age was 32.5 years with a standard deviation of 7.6 years (Table 11). Based on one-way ANOVA results at the .05 level of significance, there was no significant difference between the prescreened and screened data by trainee mean age; $p = .66$.

Approximately 70% ($n = 810$) of student trainees were female (Table 12). One-way ANOVA results indicated that there was no significant difference between the prescreened and screened data by trainee gender; $p = .716$ at the .05 level of significance. In terms of race/ethnicity, Caucasians of non-Hispanic descent comprised 69% ($n = 796$) of student trainees and the next largest race/ethnic group was Asian/Pacific Islander (17.5%, $n = 202$) followed by African American of non-Hispanic descent (5.4%, $n = 62$). Student trainees of Hispanic descent comprised 5.5% ($n = 63$) of the screened data (Table 13). Chi-square statistic indicated that there was not a significant difference between the prescreened values and screened values by race/ethnic origin; $p = .978$ at the .05 level of significance.

The percent distribution of cases by discipline (Table 14) is consistent with the prescreened data. The largest percentage of student trainees were medical residents (42.1%, $n = 497$) followed by graduate level nursing students (16.9%, $n = 200$), and social workers (11.2%, $n = 132$). A little more than 11% ($n = 132$) of trainees were social work students, almost 7% ($n = 83$) were pharmacy students and the remaining 21.8%

(n = 254) were master's degree students in allied health professions such as Occupational Therapy, Physical Therapy, Gerontology, and Health Administration. Chi-square statistic indicated that there was not a significant difference between the prescreened values and screened values by trainee discipline; p = .989 at the .05 level of significance.

A little more than three-fourths (n = 869) of student trainees reported no prior formal team training experiences (Table 15). One-way ANOVA results indicated that there was no significant difference between the prescreened and screened data based on whether trainees had prior formal team training; p = .983 at the .05 level of significance.

Almost 56% (n = 480) of the 859 individuals who reported being employed said that they work in the field of geriatrics (Table 16). However, relatively few (31.9%, n = 153) of those employed in the field of geriatrics had five or more years of paid work experience (Table 16). One-way ANOVA results indicated that there was no significant difference between the prescreened and screened data based on the number of years trainees worked for pay in geriatrics; p = .975 at the .05 level of significance.

Returning to Table 17, the highest attained item total score for screened data was 85, while the minimum attained score was 20. The median score was 56 and the mode was 61. As revealed in Table 19, a check for univariate outliers showed reasonably low values for skewness and kurtosis. One-way ANOVA results indicated that there was no significant difference between the prescreened and screened data based on average TSS total item score; p =.188 at the .05 level of significance.

Spearman's rho 2-tailed partial correlation matrix for the 17 TSS items indicates that there is a strong and positive linear relationship between Scale items.

Table 19

Descriptive Statistics for Scale Items: Check for Univariate Outliers - Data Screening

Item Label	Item Name	Median	Mode	Skew	Kurtosis
VTSS1	Function effectively in teams	4	4	-0.242	-0.338
VTSS2	Treat team members as colleagues	4	4	-0.491	-0.143
VTSS3	Identify contributions to patient care	4	4	-0.336	-0.334
VTSS4	Apply knowledge of geriatric principles for the care of older persons in team setting	3	3	0.062	-0.623
VTSS5	Ensure patient/family goals are considered	4	4	-0.288	-0.235
VTSS6	Handle disagreements effectively	3	3	-0.003	-0.393
VTSS7	Strengthen cooperation among disciplines	3	3	-0.014	-0.281
VTSS8	Carry out responsibilities specific to discipline's role	4	4	-0.255	-0.131
VTSS9	Address clinical issues succinctly	3	3	-0.144	-0.390
VTSS10	Participate actively at team meetings	3	3	-0.081	-0.561
VTSS11	Develop an interdisciplinary care plan	3	3	0.070	-0.508
VTSS12	Adjust your care to support the team goals	3	3	-0.045	-0.176
VTSS13	Develop intervention strategies	3	3	-0.053	-0.438
VTSS14	Raise appropriate issues at team meetings	3	3	-0.091	-0.327
VTSS15	Recognize when team is not functioning well	3	3	-0.080	-0.306
VTSS16	Intervene to improve team functioning	3	3	0.173	-0.336
VTSS17	Draw out team members who do not participate actively	3	3	0.302	-0.179

The correlation matrix is presented in Table 20. Item-to-total scale correlations ranged from 0.31 to 0.70 and all 2-tailed correlation coefficients were significant at the $p = 0.01$ level. Cronbach's coefficient alpha was 0.95. Together, the values for Spearman's rho and coefficient alpha indicate that TSS items are interchangeable indicators of the same underlying latent factor. These findings are similar to the empirical findings reported by Hyer, et al. (2000).

The screened TSS data presented in Table 21 shows that the vast majority of student trainees perceived themselves as having good, very good or excellent team skills with 94.4% of responders indicating that they could "Carry out responsibilities specific to your discipline's role on a team" (VTSS8). TSS item "Help draw out team members who are not participating actively in meetings" (VTSS17) had the largest percentage (44.2%) of fair to poor self ratings. TSS item "Treat team members as colleagues" (VTSS2) had the lowest percentage (5.6%) of fair to poor ratings.

CFA Results

Evaluation of Hypothesis 1, the Team Skills Scale (TSS) is a first-order two-factor structure, yielded a chi-square value of 1,505.92 with 118 degrees of freedom, chi-square degrees of freedom ratio value of 12.76, and a probability of less than 0.000. These statistics indicate that the fit of the data to the hypothesized model is not plausible. The model for Hypothesis 1, its standardized estimates and fit statistics are presented in Figure 4 and in Table 22. Additionally, there is a strong and positive correlation (0.94) between the two latent exogenous factors. This nearly perfect correlation indicates that it is likely that the two factors measure the same construct. Other fit statistics also indicate

Table 20

Spearman's rho 2-tailed Partial Correlation Matrix of the 17 Team Skills Scale Items

	VTSS1	VTSS2	VTSS3	VTSS4	VTSS5	VTSS6	VTSS7	VTSS8
VTSS1	1.000							
VTSS2	0.586**	1.000						
VTSS3	0.520**	0.529**	1.000					
VTSS4	0.542**	0.450**	0.561**	1.000				
VTSS5	0.548**	0.529**	0.534**	0.598**	1.000			
VTSS6	0.456**	0.437**	0.384**	0.374**	0.422**	1.000		
VTSS7	0.500**	0.415**	0.425**	0.432**	0.501**	0.640**	1.000	
VTSS8	0.498**	0.440**	0.460**	0.472**	0.486**	0.439**	0.495**	1.000
VTSS9	0.495**	0.359**	0.435**	0.501**	0.473**	0.437**	0.500**	0.635**

Note. Cronbach's alpha = 0.95

**$p < .01$.

Table 20 (Continued).

Spearman's rho 2-tailed Partial Correlation Matrix of the 17 Team Skills Scale Items

	VTSS9	VTSS10	VTSS11	VTSS12	VTSS13	VTSS14	VTSS15	VTSS16	VTSS17
VTSS9	1.000								
VTSS10	0.648**	1.000							
VTSS11	0.631**	0.618**	1.000						
VTSS12	0.551**	0.568**	0.648**	1.000					
VTSS13	0.588**	0.572**	0.694**	0.678**	1.000				
VTSS14	0.643**	0.701**	0.633**	0.601**	0.684**	1.000			
VTSS15	0.471**	0.495**	0.474**	0.470**	0.519**	0.613**	1.000		
VTSS16	0.553**	0.600**	0.637**	0.595**	0.624**	0.626**	0.609**	1.000	
VTSS17	0.414**	0.513**	0.488**	0.472**	0.512**	0.528**	0.500**	0.645**	1.000

Note. Cronbach's alpha = 0.95

**$p < .01$.

Table 20 (Continued).

Spearman's rho 2-tailed Partial Correlation Matrix of the 17 Team Skills Scale Items

	VTSS1	VTSS2	VTSS3	VTSS4	VTSS5	VTSS6	VTSS7	VTSS8
VTSS10	0.545**	0.431**	0.446**	0.467**	0.517**	0.449**	0.556**	0.565**
VTSS11	0.536**	0.361**	0.471**	0.576**	0.542**	0.449**	0.572**	0.492**
VTSS12	0.524**	0.467**	0.482**	0.504**	0.560**	0.508**	0.558**	0.544**
VTSS13	0.532**	0.394**	0.508**	0.595**	0.581**	0.463**	0.557**	0.559**
VTSS14	0.522**	0.378**	0.465**	0.497**	0.530**	0.455**	0.550**	0.571**
VTSS15	0.411**	0.323**	0.346**	0.339**	0.399**	0.436**	0.474**	0.453**
VTSS16	0.504**	0.382**	0.415**	0.505**	0.470**	0.561**	0.616**	0.468**
VTSS17	0.417**	0.308**	0.301**	0.404**	0.422**	0.448**	0.504**	0.372**

Note. Cronbach's alpha = 0.95

**$p < .01$.

Table 21

Percent of Responses by Likert-type Value for Each Team Skills Scale Item - Screened Data

	Variable Name	Poor	Fair	Good	Very Good	Excellent
Function effectively in teams	VTSS1	1.3%	10.9%	34.2%	40.3%	13.3%
Treat team members as colleagues	VTSS2	0.4%	5.2%	24.2%	44.4%	25.8%
Identify contributions to patient care	VTSS3	1.4%	10.5%	30.5%	41.3%	16.4%
Apply knowledge of geriatric principles for the care of older persons in team setting	VTSS4	4.0%	25.4%	35.6%	27.3%	7.7%
Ensure patient/family goals are considered	VTSS5	1.2%	9.2%	33.6%	40.8%	15.3%
Handle disagreements effectively	VTSS6	1.2%	17.9%	43.8%	31.7%	5.4%
Strengthen cooperation among disciplines	VTSS7	1.3%	18.8%	44.8%	29.9%	5.2%
Carry out responsibilities specific to discipline's role	VTSS8	0.4%	5.4%	34.2%	43.2%	16.8%

Table 21 (Continued).

Percent of Responses by Likert-type Value for Each Team Skills Scale Item - Screened Data

	Variable Name	Poor	Fair	Good	Very Good	Excellent
Address clinical issues succinctly	VTSS9	2.1%	16.8%	38.1%	34.2%	8.9%
Participate actively at team meetings	VTSS10	1.4%	15.5%	36.9%	33.1%	13.1%
Develop an interdisciplinary care plan	VTSS11	8.6%	28.3%	36.9%	21.3%	4.9%
Adjust your care to support the team goals	VTSS12	1.2%	14.6%	44.4%	32.7%	7.1%
Develop intervention strategies	VTSS13	2.0%	19.3%	39.9%	32.3%	6.4%
Raise appropriate issues at team meetings	VTSS14	1.4%	15.0%	41.3%	33.6%	8.7%
Recognize when team is not functioning well	VTSS15	1.4%	13.6%	41.9%	33.3%	9.8%
Intervene to improve team functioning	VTSS16	4.7%	31.0%	40.3%	20.3%	3.7%
Draw out team members who do not participate actively	VTSS17	8.6%	35.7%	37.8%	14.2%	3.7%

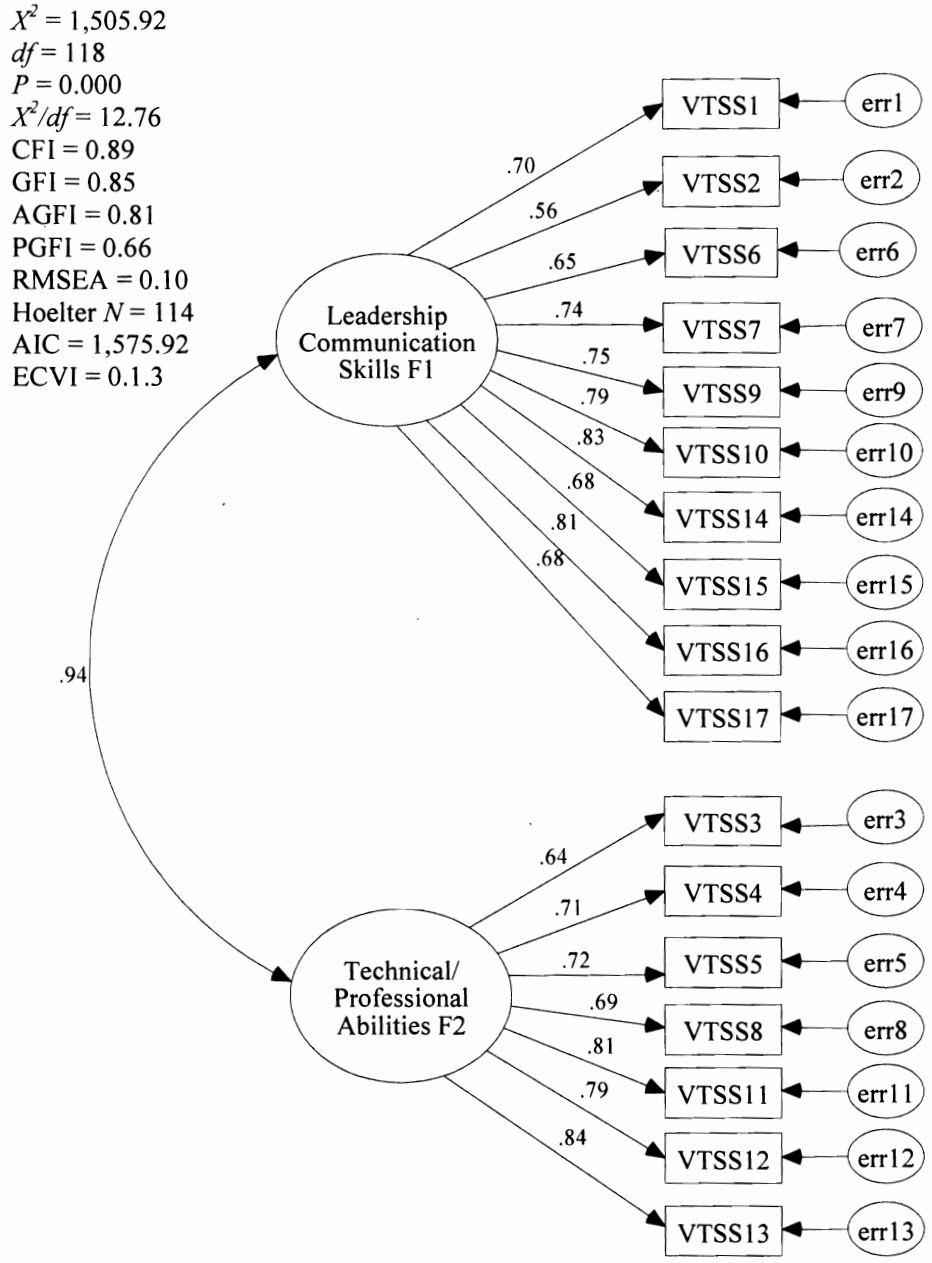


Figure 4: Standardized Factor Loadings for the Initial Two-Factor TSS Measurement Model

Table 22

Goodness of Fit Statistics for the Initial and Revised Two-Factor Structure of the TSS

Fit Statistics	Initial Two-Factor Model	Revised Two-Factor Model	Revised Two-Factor Model with Correlated Error Terms
Chi-square	1,505.92	777.56	48.08
Degrees of Freedom (*df*)	118	109	16
Likelihood Ratio (X^2/df) ratio range of 2 to 1	12.76	7.13	3.01
Adjusted goodness-of-fit index (AGFI) ≥ .90	0.81	0.90	0.99
Comparative-fit index (CFI) ≥ .95	0.89	0.95	0.98
Goodness-of-fit index (GFI) ≥ .90	0.85	0.93	0.99
Parsimony goodness-of-fit index (PGFI) 0.50 to 0.59	0.66	0.66	0.35
Root mean square error of approximation (RMSEA) < .05	0.10	0.07	0.04
Hoelter critical *N*, at .05 level ≥ 200	114	204	645
Expected cross-validation index (ECVI) no set value range, but smallest value is best	1.3	0.73	0.09
Akaike information criterion (AIC) no set value range, but the smallest value is best	1,575.92	106.08	106.08

that the two-factor model is not a good fit to the data. For example, the comparative-fit index (CFI) should equal or exceed 0.95 for a good fitting model; however, the CFI (0.89) for the initial model was well below this criterion. Further, a good fitting model should have a significant value for the root mean square error of approximation (RMSEA) which was not the case for the initial fit of the two-factor model (RMSEA = 0.100). The values for CFI RMSEA are strongly indicative of inferior goodness of fit between the hypothesized two-factor model and the GITT data.

Given the poor chi-square value and the less than adequate values for other fit statistics, post hoc model modifications were performed in an attempt to develop a better fitting and possibly more parsimonious model. Specifically, observed variables with modifications indexes (MI), related to the error terms, with values greater than or equal to 50 were deleted from the model because large MIs represent a high degree of overlap in item content. Additionally, large MI values present opportunities for improving the goodness of fit (GOF). Improvement in GOF is achieved via reduction in the value of chi-square. After deleting indicators with high MI values, the remaining indicators with MI values greater than or equal to 10 were allowed to correlate.

While there was a large reduction in the value of chi-square ($X^2 = 48.08$, $df = 16$, chi-square likelihood ratio = 3.01) for the revised two-factor structure with correlated measurement error as shown in Figure 5, chi-square was still significant at the $p = 0.000$ level. Indicators that were deleted from the model are presented in Table 23 along with the respective error covariance and MI expected change value. Additionally, the correlation of the two latent exogenous factors was 0.95. This nearly perfect correlation

$X^2 = 48.08$
$df = 16$
$P = 0.000$
$X^2/df = 3.01$
CFI = 0.98
GFI = 0.99
AGFI = 0.99
PGFI = 0.35
RMSEA = 0.04
Hoelter $N = 645$
AIC = 106.08
ECVI = 0.09

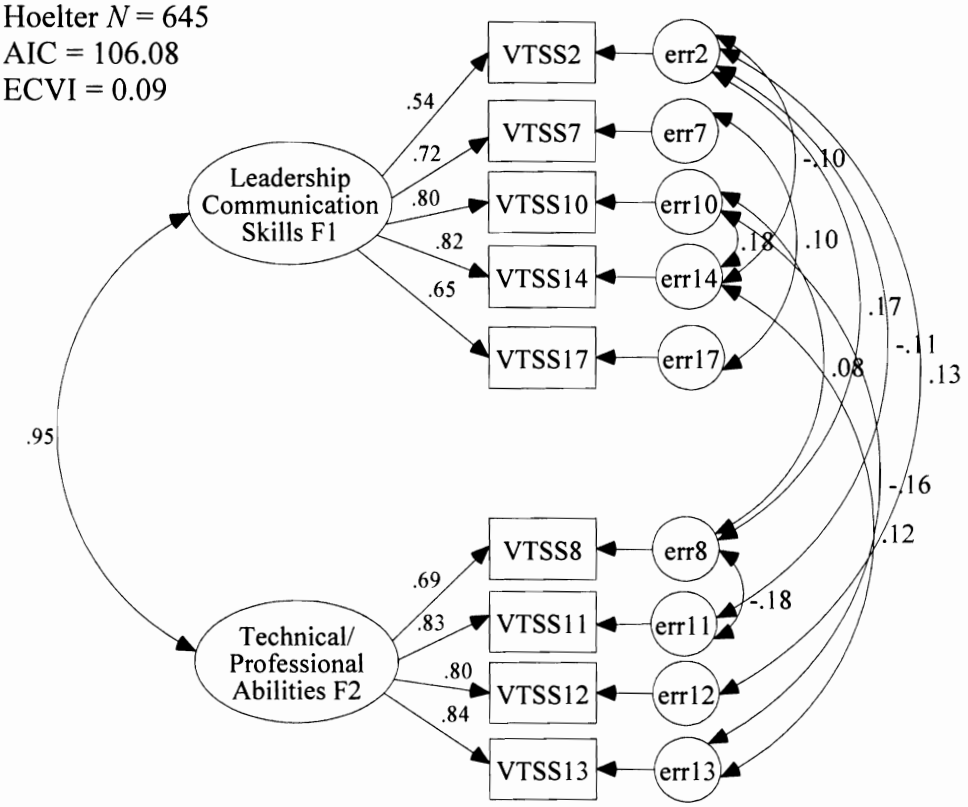


Figure 5: Standardized Factor Loadings for the Revised Two-Factor TSS Measurement Model with Correlated Error Terms

Table 23

TSS Items Deleted from the Revised Two-Factor Model

Deleted TSS Items	Associate Error Covariance Indicator	Modification Indicator Value
Function effectively in an interdisciplinary team" (VTSS1)	VTSS2	143.96
Identify contributions to patient care that different disciplines can offer" (VTSS3)	VTSS2	83.31
Apply your knowledge of geriatric principles for the care of older persons in a team care setting" (VTSS4)	VTSS3	59.30
Ensure that patient/family preferences/goals are considered when developing the team's care plan" (VTSS5)	VTSS2	66.46
Handle disagreements effectively (VTSS6)	VTSS7	136.11
Address clinical issues succinctly in interdisciplinary meetings (VTSS9)	VTSS8	79.56
Recognize when the team is not functioning well" (VTSS15)	VTSS16	50.90
Effectively to improve team functioning (VTSS16)	VTSS17	107.90

indicates that it is likely that the two factors are measuring the same construct. Values for other fit indices were within the expected range for an adequately fitting model with the exception of the parsimony goodness-of-fit index (PGFI = 0.35). An adequate fit is reflected by a parsimony index value between 0.50 and 0.59 (Maruyama, 1998).

There are four criteria suggesting that the two-factor model is less than adequate. First, both the initial and revised models resulted in a significant chi-square value. Although the chi-square test is sensitive to sample size and larger samples often result in a significant chi-square value, the criterion for a large sample has not been clearly defined (Arbuckle & Wothke, 1999; Tabachnik & Fidell, 1996). Arguably, the GITT data which contains 1,180 cases, as used for this study, is not very large. Therefore, a non-significant chi-square value is an appropriate fit statistic for assessing model plausibility in this study.

Second, the positive and near perfect correlation between the two latent exogenous factors is a strong signal that the TSS measures only one factor. This finding supports descriptive information about the TSS which showed that all Spearman's rho 2-tailed partial correlation coefficients were significant at the 0.01 level. Also, Cronbach's alpha (0.945) suggests very high internal consistency and to some extent, item interchangeability. The third criterion suggesting that the two-factor model is less than adequate is the value for PGFI. PGFI assesses model complexity as a function of the number of estimated parameters and reflects the trade-off between the fit of a model and model simplicity. The value for PGFI was well below the expected range.

Finally, even after deleting eight TSS items and allowing measurement errors to correlate the revised model was not fully adequate fit. The value of Cronbach's alpha for the remaining nine TSS items was 0.913. Also, much of the improvement in the fit statistics for the revised two-factor model was achieved by allowing errors terms to correlate. According to Wan (2002), correlated measurement errors suggest shared common variance, not accounted for by the factors. Another cause of correlated errors is the potential overlap in item content (Raykov & Marcoulides, 2000).

It is concluded that the two-factor model, both initial and revised, does not adequately describe the data based on the four criteria discussed above. Therefore, Hypothesis 1 is not supported and the model is rejected. However, this does not mean that the model was poorly specified, it only means that the model does not fit optimally with GITT data. The confirmatory nature of the study ends here and all analyses from this point forward are exploratory.

Exploratory Model Fitting

The two-factor CFA model of the TSS was not confirmed as a plausible fit to the GITT data. Therefore, in this section, CFA is used to explore fit of the data to a one-factor model containing all 17 TSS items and the model will be revised, as needed.

Initial One-Factor Model with all 17 TSS Items

TSS data were not an adequate fit to the two-factor model with 17 indicators. Therefore, the performance of a one-factor model with all 17 indicators is evaluated in this section. The 17-item one-factor model is composed of one latent exogenous factor, individual-level team competencies. All 17 observed endogenous variables load on the

exogenous latent factor. The unobserved latent factor has no definite metric scale; therefore, VTSS1 is constrained to a value of 1. This constraint is necessary for the model to be identified. The model in Figure 6 also depicts 17 error terms, one associated with each TSS item. In total, there are 35 parameters in the model. Of the 35 parameters, 33 will be estimated (16 of the 17 observed variables, and 17 errors of measurement associated with each observed variable).

The test that the TSS is a one-factor structure with 17 indicators yielded a chi-square value of 1,657.79 with 119 degrees of freedom and a probability of less than 0.000. This test statistic indicates that, given the present data, this one-factor model is not plausible. These fit statistics suggest that the model is an unlikely event; to include the chi-square likelihood ratio (13.93), the CFI (0.88), AGFI (0.79) and the RMSEA (0.105). It is also noted that there is a near perfect correlation (.95) between the two latent factors. The intercorrelation produced in CFA provides a meaningful identification of the correlations between factors. CFA intercorrelation is a key advantage over exploratory factor analysis (EFA) because EFA intercorrelations are strongly influenced by details of the specific rotation method used.

The poor fit of the one-factor structure with 17 indicators was not unexpected given the near perfect correlation (Cronbach's alpha = 0.95) between the 17 TSS items. This correlation coefficient signifies a high degree of redundancy between TSS items and indicates a lack of discriminate validity between the two factors. Figure 7 depicts the standardized factor loadings for the initial one-factor model with 17 TSS indicators.

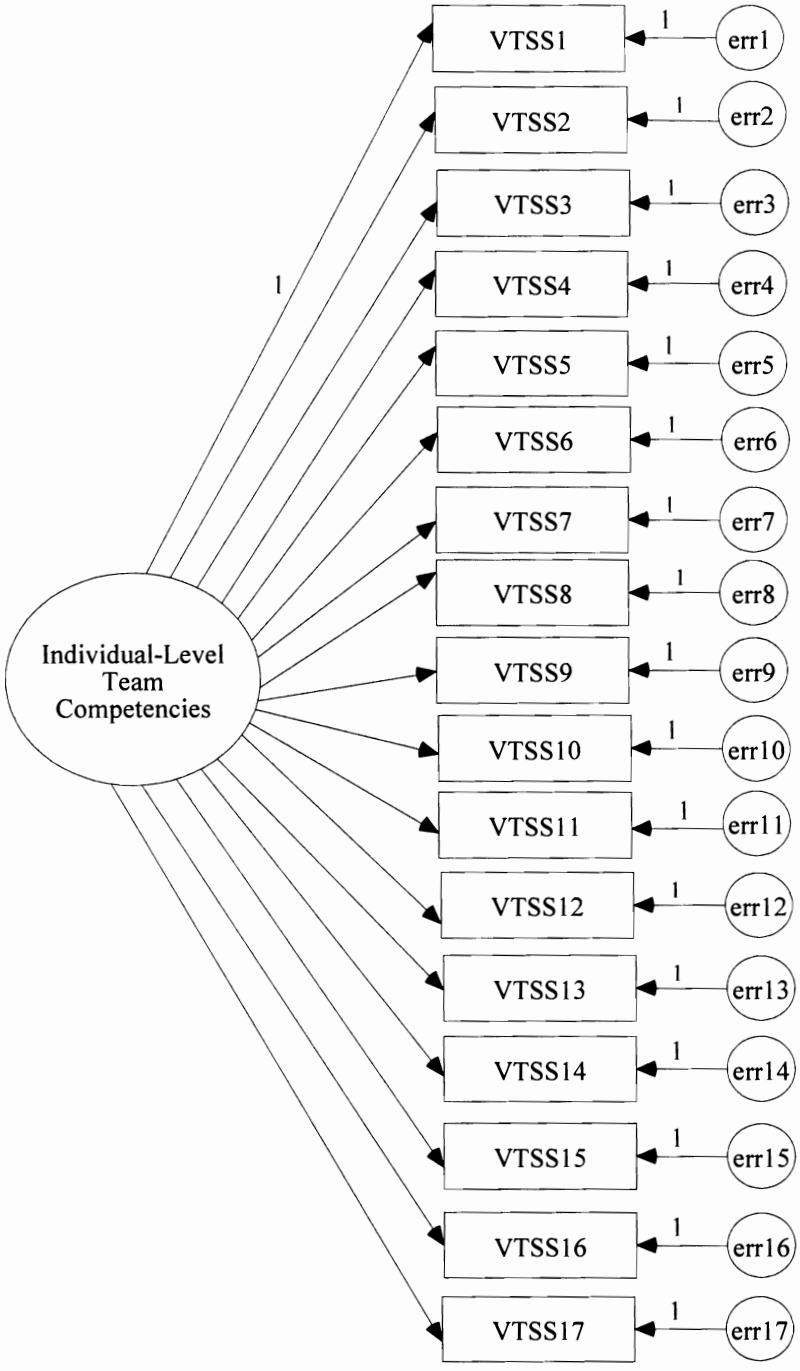


Figure 6: Initial One-Factor CFA Model of the TSS with 17 Indicators

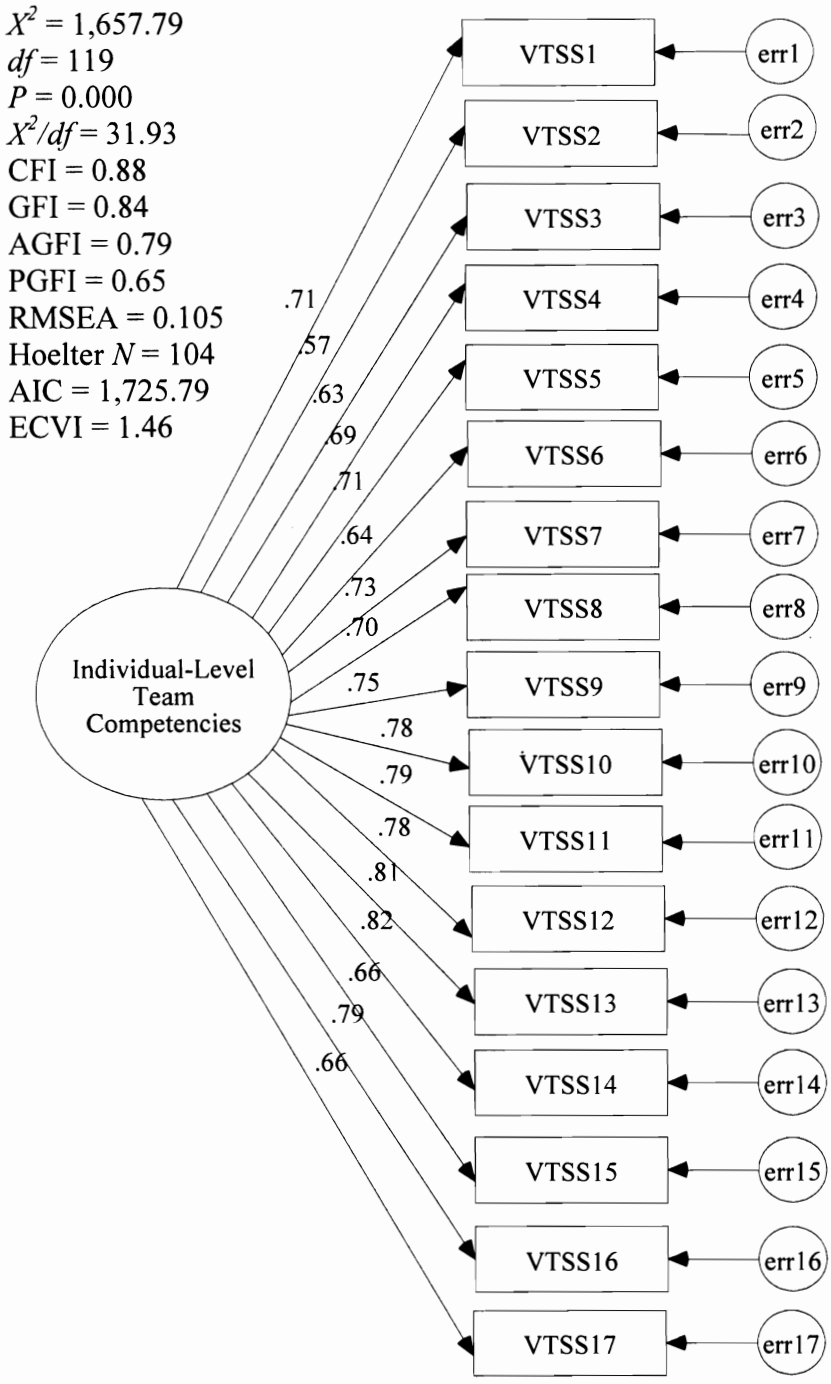


Figure 7: Standardized Factor Loadings for the Initial One-Factor TSS Measurement Model with 17 Indicators

Initial One-Factor Model with Eight TSS Items

Post hoc model modifications were performed in an attempt to develop a better fitting and possibly more parsimonious model. Specifically, the eight indicators, shown in Table 24, with modifications indices (MI) greater than or equal to 50 were deleted from the model; which should reduce measurement redundancy. However, all Spearman's rho correlations were significant at the 0.01 level (2-tailed) and the value for Cronbach's alpha was 0.91, suggesting that there may still be some redundancy in the measurement instrument. Spearman's rho correlations are presented in Table 25.

The revised one-factor measurement model, now with only eight indicators, is presented in Figure 8 and the model with standardized estimates is presented in Figure 9. The test that the TSS is a one-factor structure with eight indicators yielded a chi-square value of 173.61 with 20 degrees of freedom and a probability of less than 0.000. This test statistic indicates that, given the present data, this one-factor model is better than the model with all 17 TSS items; but, the plausibility of the model is questionable because some important fit statistics (chi-square likelihood ratio = 8.68 and RMSEA = 0.08) suggest that the model is not a good fit to the data.

Given the sub-optimal fit, further modifications were performed by allowing all MIs with values 10 or larger to correlate. Standardized factor loadings for the revised one-factor model with eight TSS indicators and correlated measurement error is presented in Figure 10. The test that the TSS is a one-factor structure with eight indicators and correlated measurement error yielded a chi-square value of 46.25 with 15

Table 24

TSS Items Deleted from the Revised One-Factor Model

Deleted TSS Items	Associate Error Covariance Indicator	Modification Indicator Value
Function effectively in an interdisciplinary team" (VTSS1)	VTSS2	132.86
Identify contributions to patient care that different disciplines can offer" (VTSS3)	VTSS2	75.40
Apply your knowledge of geriatric principles for the care of older persons in a team care setting" (VTSS4)	VTSS5	72.42
Ensure that patient/family preferences/goals are considered when developing the team's care plan" (VTSS5)	VTSS2	58.58
Handle disagreements effectively (VTSS6)	VTSS7	150.82
Carry out responsibilities specific to your discipline's role on a team (VTSS8)	VTSS9	72.50
Participate actively at team meetings (VTSS10)	VTSS14	61.45
Recognize when the team is not functioning well" (VTSS15)	VTSS16	74.64
Help draw out team members who are not participating actively in meetings (VTSS17)	VTSS16	135.32

Table 25

Spearman's rho Correlations for the Eight TSS Items Retained in the One-Factor Measurement Model

	VTSS2	VTSS7	VTSS9	VTSS11	VTSS12	VTSS13	VTSS14	VTSS16
VTSS2	1.000							
VTSS7	0.415**	1.000						
VTSS9	0.359**	0.500**	1.000					
VTSS11	0.361**	0.572**	0.631**	1.000				
VTSS12	0.467**	0.558**	0.551**	0.648**	1.000			
VTSS13	0.394**	0.557**	0.588**	0.694**	0.678**	1.000		
VTSS14	0.378**	0.550**	0.643**	0.633**	0.601**	0.684**	1.000	
VTSS16	0.382**	0.616**	0.553**	0.637**	0.595**	0.624**	0.626**	1.000

* *Note*. Cronbach's alpha = 0.91

**$p < .01$ (2-tailed)

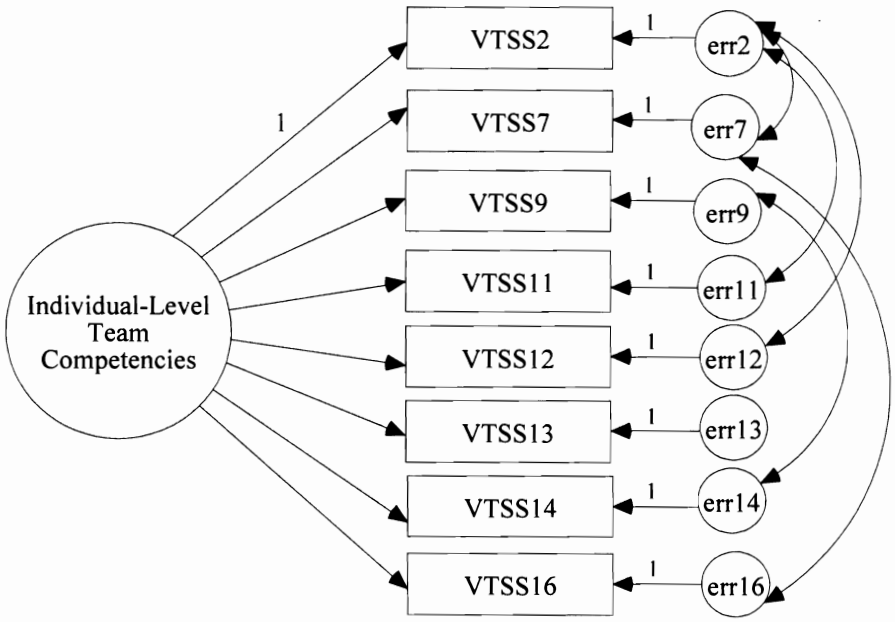


Figure 8: Revised One-Factor Measurement Model with Eight Indicators

Note. The factor in this model is believed to be self-perceived team collaboration skills

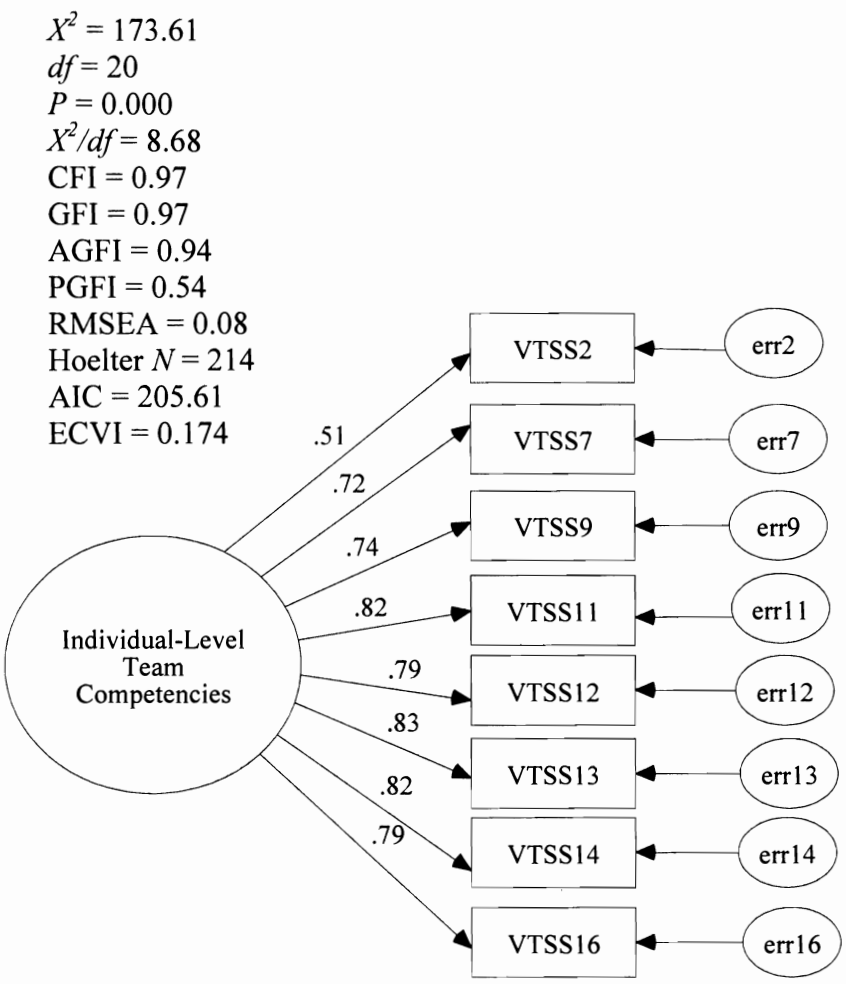


Figure 9: Standardized Estimates for the Revised One-Factor Model with Eight Indicators

Note. The factor in this model is believed to be self-perceived team collaboration skills

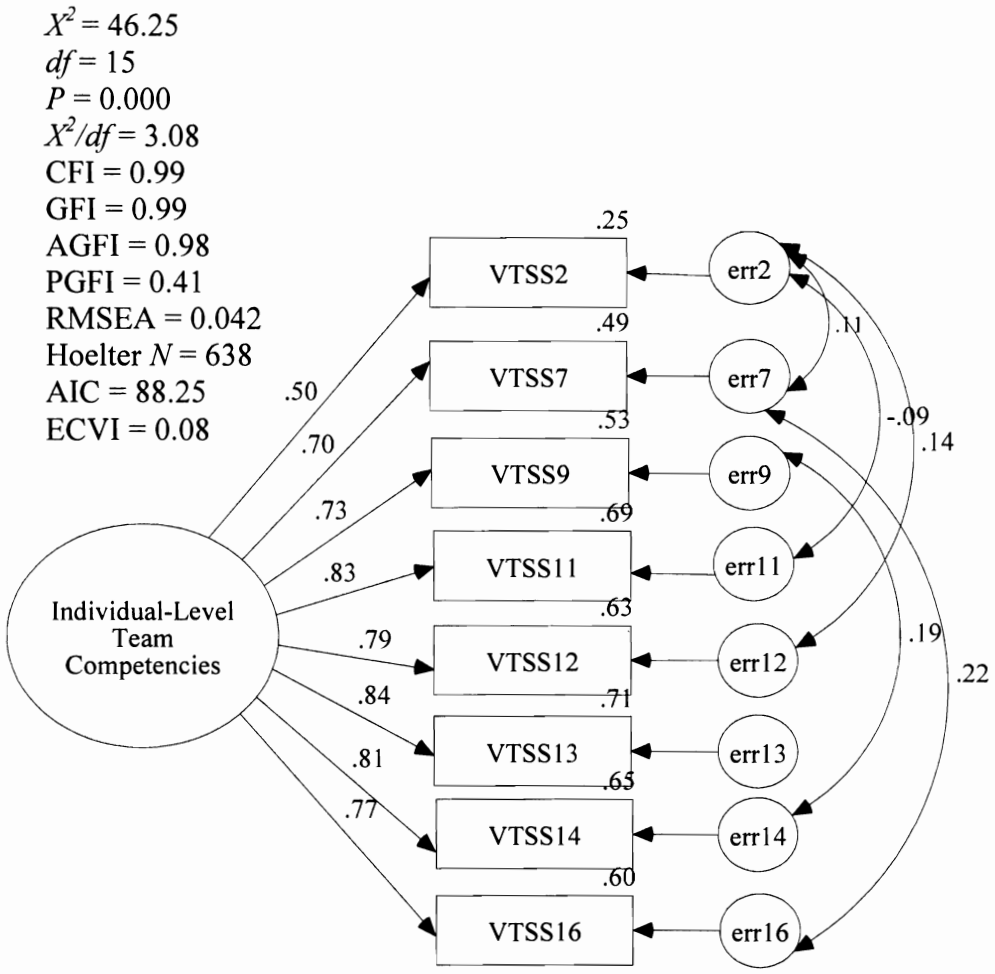


Figure 10: Standardized Estimates for the Revised One-Factor Model with Eight Indicators and Correlated Measurement Errors

Note. The factor in this model is believed to be self-perceived team collaboration skills

degrees of freedom, chi-square likelihood ratio = 3.08, and a significant probability ($p = 0.000$); also, the parsimony goodness-of-fit index (0.41) is below the expected value. This is likely a result of achieving model fit by allowing error terms to correlate. These statistics indicate that, given the present data, this one-factor model with eight indicators and correlated measurement errors is not a good fit to the data. However, other fit statistics in support the plausibility of the model (chi-square CFI = 0.99, AGFI = 0.98, RMSEA = 0.04, and Hoelter's $N = 638$). Fit statistics are presented in Table 26.

Estimates for factor loadings and squared multiple correlations (SMC) for the revised one-factor model with eight TSS indicators and correlated measurement errors are shown in Table 27. All standardized factor loadings are significant. SMCs indicate that "Develop intervention strategies that help patients attain goals" (VTSS13), SMC = 0.71 and "Develop an interdisciplinary care plan" (VTSS11), SMC = 0.69 are the most reliable indicators of the individual-level team competencies latent exogenous factor. While, "Strengthen cooperation among disciplines (VTSS7)" was the weakest (SMC = 0.49) indicator of this factor The revised one-factor model with eight indicators (VTSS2, VTSS7, VTSS9, VTSS11, VTSS12, VTSS13, VTSS14 and VTSS16) and five sets of correlated measurement errors are retained for further evaluation of measurement equivalence. Evidence of factor invariant across random samples of the data would provide additional support for the plausibility of the revised 8-item CFA model. Therefore, the next step is to demonstrate model invariance.

Table 26

Goodness of Fit Statistics for the One-Factor Structure of the TSS

Fit Statistics	Initial One-Factor Model with 17 indicators	Revised One-Factor Model with 8 Indicators	Revised One-Factor Model with 8 Indicators and Correlated Errors
Chi-square (X^2)	1,657.79	173.61	46.25
Degrees of Freedom (*df*)	119	20	15
Likelihood Ratio (X^2/df) ratio range of 2 to 1	13.93	8.68	3.08
Comparative-fit index (CFI) ≥ .95	0.88	0.97	0.99
Goodness-of-fit index (GFI) ≥ .90	0.84	0.97	0.99
Adjusted goodness-of-fit index (AGFI) ≥ .90	0.79	0.94	0.98
Parsimony goodness-of-fit index (PGFI) 0.50 to 0.59	0.65	0.54	0.41
Root mean square error of approximation (RMSEA) < .05	0.105	0.08	0.042
Hoelter critical *N*, at .05 level ≥ 200	104	214	638
Akaike information criterion (AIC) no set value range, but the smallest value is best	1,725.79	205.61	88.25
Expected cross-validation index (ECVI) no set value range, but smallest value is best	1.46	0.174	0.08

Table 27

Factor Loadings and Squared Multiple Correlations Revised One-Factor Model with Correlated Measurement Errors

Observed Variables	Unstandardized Loadings			Standardized Loadings	SMC
	Individual-Level Team Competencies			Individual-Level Team Competencies	
	Estimate	S.E.	C.R.	Estimate	
VTSS2	1.00			0.50	0.25
VTSS7	1.376	0.083	16.642	0.70***	0.49
VTSS9	1.579	0.098	16.102	0.73***	0.53
VTSS11	1.96	0.118	16.61	0.83***	0.69
VTSS12	1.571	0.089	17.720	0.79***	0.63
VTSS13	1.781	0.104	17.159	0.84***	0.71
VTSS14	1.670	0.099	16.843	0.81***	0.65
VTSS16	1.661	0.100	16.574	0.77***	0.60

Note. S.E. = Standard Error, C.R. = Critical Ratio and SMC = Squared Multiple Correlations
*** $p < 0.000$

Cross-Validation of the Revised One-Factor Model

The next question to be addressed is does the factorial structure of the revised one- factor model with eight indicators and correlated errors replicate. This question supports factor model with eight indicators and correlated errors replicate. This question supports Hypothesis 2 which states that performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples.

To cross-validate the model, the two random samples, each containing 590 cases, were analyzed simultaneously (stacked model) to test for model invariance. Specifically, fit statistics were estimated for both random samples simultaneously. The key goodness-of-fit statistics to evaluate a stacked model are chi-square, chi-square likelihood ratio, CFI, RMSEA, and chi-square difference values. Analysis of a stacked model yields only one set of fit statistics and the chi-square value provides the baseline value against which all subsequent tests for invariance are compared. Specifically, if there is no significant difference between the unconstrained stacked model and constrained stacked model then it can be concluded that all factor loadings are invariant across the two samples.

Finally, equality constraints were imposed on the stacked model and it was again tested for invariance (equivalence across the two random samples). Figure 11 shows the model with equality constraints. As labeled, this model specifies that the factor loadings and factor variances be constrained equal for the two simultaneous samples. The factor loading regression paths are labeled as p7, p9, p11, p12, p13, p14, and p16 and the factor variance is labeled v_i-ltc. Also, note that the reference variable continues to have an assigned value of 1.00 for purposes of model identification (constrained to equal 1.00).

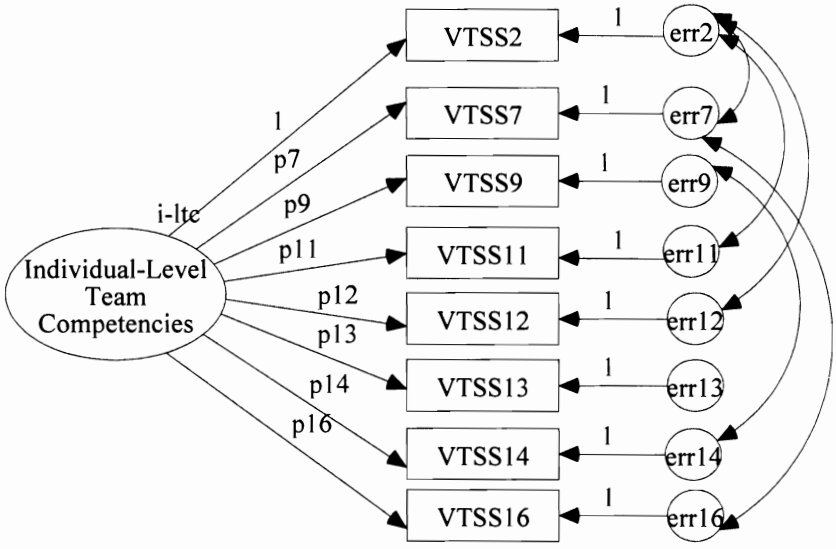


Figure 11: Revised One-Factor Model with Correlated Errors and Equality Constraints.

Note. The factor in this model is believed to be self-perceived team collaboration skills

Analysis demonstrates that the model is a reasonably good fit to the data and that all factor loadings are invariant across the two samples because the chi-square difference statistic is non-significant ($\Delta X^2 = 7.45$, $X^2/df = 1.74$). The chi-square difference value is used to compare the simultaneous model without constraints to the one with constraints. The chi-square value (73.67) for the constrained model was slightly larger than the chi-square value (66.35) for the model without equality constraints. Therefore, the chi-square difference was 7.42. This was expected given the increase in the degrees of freedom for the model with equality constraints. Model validation for invariance demonstrates that the one-factor model with eight indicators and correlated errors is a reasonably good fit to the data. Standardized estimates and goodness-of fit statistics for the constrained model are presented in Figure 12 and in Table 28.

Covariance Structure Model

Using the validated one-factor model with eight indicators and correlated measurement errors, Hypothesis 3 was evaluated (student trainee age, attitudes about the physician as team leader and sole patient care decision-maker, and attitudes about the quality of patient care that is delivered by teams are predictors of self-perceived team skills as measured by the plausible TSS measurement model). Covariance structural analysis provides parameter estimates simultaneously for the measurement model and for the structural equation model.

The interdisciplinary healthcare team literature indicates that two attitudinal variables influence behavior and perceptions about one's team skills (Heinemann, et al., 1999). The first variable identified by Heinemann, et al. is team member attitude about

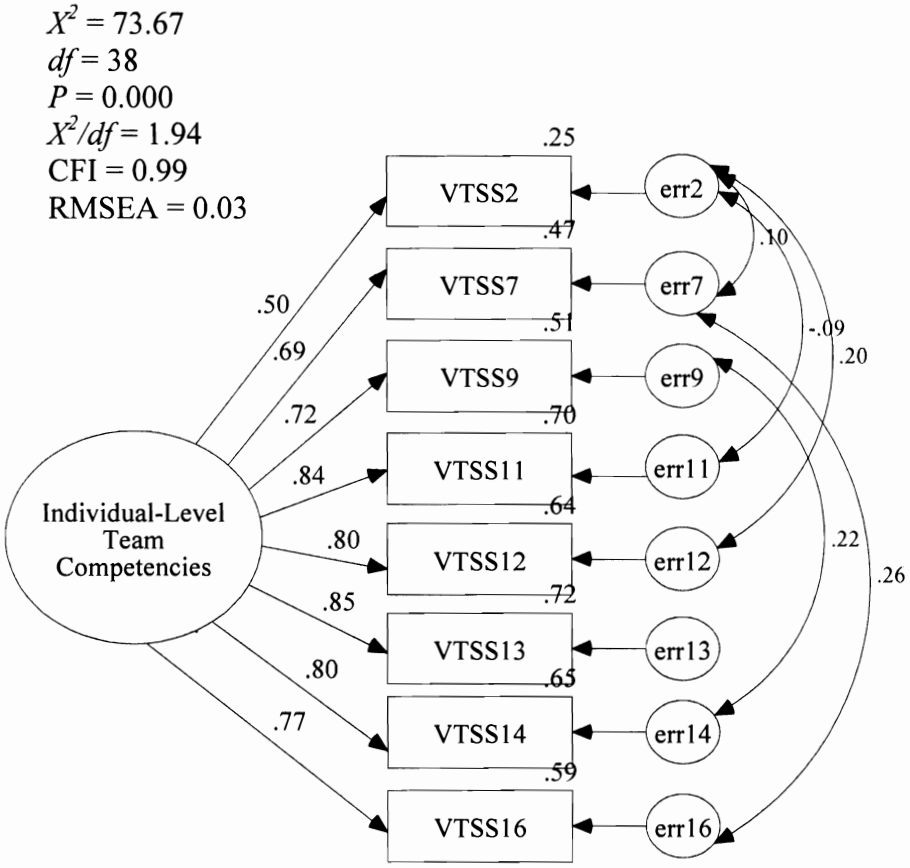


Figure 12: Standardized Simultaneous Estimates Revised One-Factor Model Correlated Error and Equality Constraints

Note. The factor in this model is believed to be self-perceived team collaboration skills

Table 28

Fit Statistics for Replication of the Simultaneous Model without and with Equality Constraints for the Revised One-Factor Model

Fit Statistics	Revised One-Factor Model Simultaneous Estimates without Equality Constraints	Revised One-Factor Model Simultaneous Estimates with Equality Constraints	Difference Values
Chi-square (X^2)	66.25	73.67	7.45
Degrees of Freedom (*df*)	30	38	8
Probability (*P*)	0.0001	0.0001	*NS*
Likelihood Ratio (X^2/df) ratio range of 2 to 1	2.21	1.94	0.27
Comparative-fit index (CFI) ≥ .95	0.99	0.99	0
Root mean square error of approximation (RMSEA) < .05	0.03	0.03	0

the quality of patient care that is delivered by teams. The other variable is a team member's attitudes about having a physician as the leader and primary decision maker in an interdisciplinary team.

Age has often been noted as a factor that influences an individual's perceptions about teamwork. However, there is not consensus about the direction of the relationship between age and perceptions about teamwork. Some of the literature suggests that younger healthcare professionals are more inclined to have more positive perceptions about teamwork than are older healthcare professionals because younger healthcare working are more likely to have experienced interdisciplinary team training and/or been a part of clinical applications of the team approach (Garner & Orelove, 1994). However, Coogle, Parham, Cotter, et al. (2005) found a positive relationship between maturity, as measured by age and years of experience working in healthcare, and positive attitude about the quality of care delivered by interdisciplinary teams.

A covariance structure equation model that includes measures of attitudes, as captured from GITT pretest data and trainee age, are used to assess their effect on self-perceived individual-level team competencies. The initial covariance structural model is depicted in Figure 13. In this model, the endogenous latent factor, self-perceived team collaboration skills, is associated with eight indicators, their respective error terms and correlated measurement error. Additionally, there are three exogenous continuous variables: age of student trainees, and the summated values for each of the two subscales from the *Attitudes Toward Health Care Teams Scale* (Heinemann, et al., 1999).

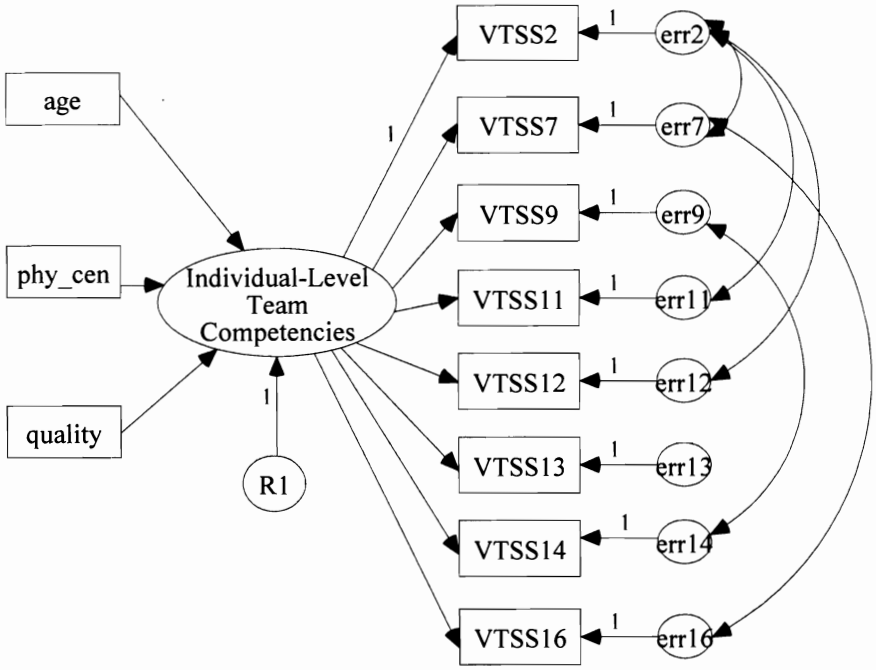


Figure 13: Initial Covariance Structure Model of the TSS with Eight Indicators and Correlated Measurement Errors

Note. The factor in this model is believed to be self-perceived team collaboration skills

According to Heinemann, and colleagues (1999) the physician centrality (phy_cen) subscale measures a healthcare professional's perceptions about the physician of team leader and primary decision maker and the quality of care/process (quality) subscale measures a team member's perceptions of the quality of care delivered by health care teams. Thirty-nine cases were deleted from the data set because of missing data for the age variable; therefore, 1,141 cases were used in the analysis of the structural model. The goodness-of-fit statistics in Table 29 show that the model had a poor fit ($X^2 = 289.70$, $df = 39$, $X^2/df = 7.43$, $p = 0.000$). Standardized estimates for the initial structural model are shown in Figure 14. Student trainee age was not statistically significant as indicated in Table 30 by the critical ratio (C.R.) value (0.333). The C.R. value needs to be greater than ± 1.96 to be considered a significant predictor. Therefore, age was eliminated as a student trainee characteristic (exogenous variable) that affects the variation in individual-level team competencies. The revised structural model and parameter estimates for the two remaining predictors are shown in Figure 15. Physician centrality (a negative association) suggests that positive self-perceived team skills is negatively associated with a trainee's belief that physicians should be the leader and primary decision maker in an interdisciplinary team. Quality of care/process also continued to have statistically significant standardized estimates. This variable indicates that trainees who have positive self-perceived team skills also believe that interdisciplinary teams deliver quality patient care. While there was a reduction in the value of chi-square ($X^2 = 250.70$), the chi-square ratio increased ($X^2/df = 8.36$) as did Hoelter critical N (200). Therefore, there is insufficient support for Hypothesis 3. The student trainee characteristics included in the

Table 29

Covariance Structure Model of Individual-level Team Competencies

Goodness-of-Fit Statistics

Fit Statistics	Initial Covariance Structural Model	Revised Covariance Structural Model
Chi-square (X^2)	289.70	250.70
Degrees of Freedom (*df*)	39	30
Probability	0.000	0.000
Likelihood Ratio (X^2/df) ratio range of 2 to 1	7.43	8.36
Comparative-fit index (CFI) $\geq$ .95	0.96	0.96
Root mean square error of approximation (RMSEA) < .05	0.08	0.08
Hoelter critical *N*, at .05 level $\geq$ 200	215	200

$X^2 = 289.70$
$df = 39$
$P = 0.000$
$X^2/df = 7.43$
CFI = 0.96
RMSEA = 0.08
Hoelter $N = 215$

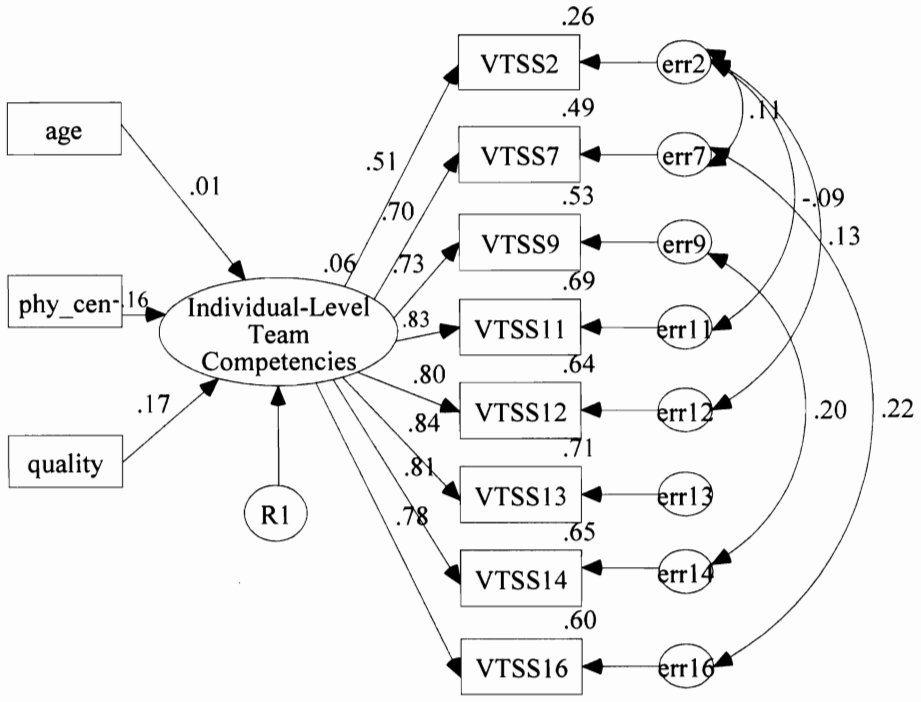


Figure 14: Standardized Estimates for the Initial Covariance Structure Model of the TSS with Eight Indicators and Correlated Measurement Errors

Note. The factor in this model is believed to be self-perceived team collaboration skills

Table 30

Initial and Revised Structural Equation Model Factor Loadings for Predictors of the One-Factor TSS Model with Eight Indicators and Correlated Measurement Errors

Predictors	Initial Model				Revised Model			
	Unstandardized Estimates			Standardized Estimates	Unstandardized Estimates			Standardized Estimates
	Estimate	S.E.	C.R.		Estimate	S.E.	C.R.	
Age	0.001	0/002	0.333	0.010				
Quality	0/009	0.002	5.45	0.172***	0.009	0.002	5.471	0.172***
Phy_Cen	-0.013	0.003	-5.162	-0.162***	-0.013	0.003	-5.119	-0.160***

Note. S.E. = Standard Error, C.R. = Critical Ratio and SMC = Squared Multiple Correlations

*** $p < 0.000$

$X^2 = 250.70$
$df = 30$
$P = 0.000$
$X^2/df = 8.36$
CFI = 0.96
RMSEA = 0.08
Hoelter $N = 200$

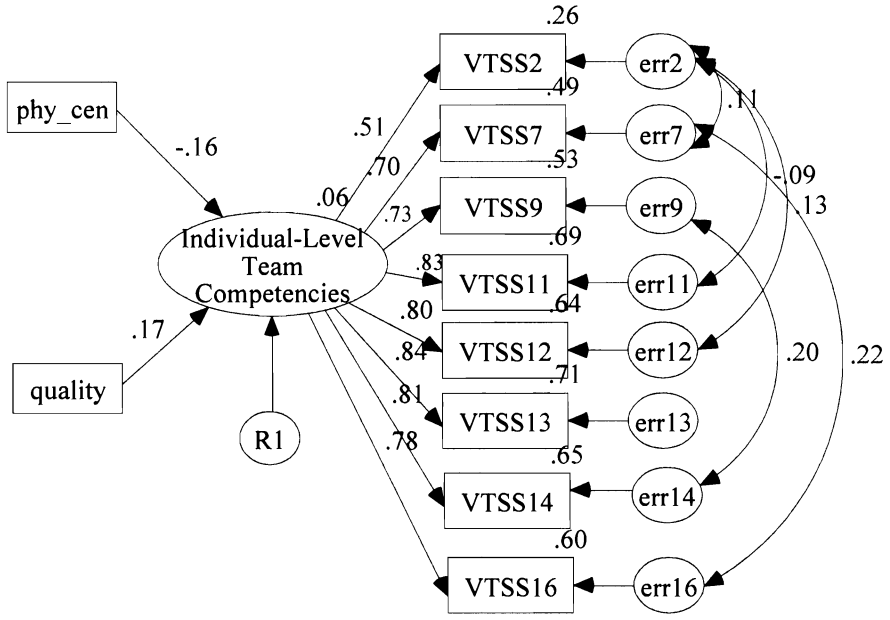


Figure 15: Standardized Estimates for the Revised Covariance Structure Model of the TSS with Eight Indicators and Correlated Measurement Errors

Note. The factor in this model is believed to be self-perceived team collaboration skills

structural model do not fit well to the GITT data. Findings on the lack of effects of these characteristics may be associated with the CFA model's marginal fit to the data rather then being indicative of a lack of effect on a trainee's self-perceived team competencies.

Chapter Summary

Chapter Four presented results for the three hypotheses tested in this study. Hypothesis 1 (The Team Skills Scale is a first-order two-factor structure) was not supported. Rather, results suggest that the TSS is a one-factor structure comprised of eight of the original 17 indicators. The one-factor model includes five sets of correlated measurement errors which suggest that the indicators have shared common variance not accounted for by the model. The one-factor model with eight indicators and correlated errors was further evaluated for invariance. Results supported Hypothesis 2 (Performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples). Finally, Hypothesis 3 was evaluated. Results did not fully support the proposed covariance structure model. This model proposed that three variables of age, attitudes about the physician's team role and quality of team delivered patient care would predict responses to the plausible TSS measurement model. However, only the two attitude variables were found to significantly predict the variation in responses to the TSS.

CHAPTER 5: DISCUSSION, IMPLICATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

Chapter 5 provides a discussion of the findings, implications, theoretical considerations, limitations of the study, and suggestions for future research. In this study, pretest Team Skills Scale (TSS) data from the Geriatric Interdisciplinary Team Training (GITT) program were used to examine the factorial validity of the TSS and to analyze a covariance structural model of the validated instrument. In its original form, the TSS was developed for use in evaluating the impact (pretest/posttest change) of the GITT program on an individual's perceptions of her/his geriatric interdisciplinary team skills.

Self-perception of what one can do (skills/abilities) is more generally referred to as self-efficacy. Self-efficacy refers to a belief in one's competence to perform a task or group of tasks (Bandura, 1997). There is evidence that self-efficacy is a predictor of actual behavior (Bandura, 1997; Pajares, 2003). Additionally, positive self-perceptions have been linked to persistence with the desired behavior change (Ajzen, 1991; Bandura, et al., 1977; Pajares, 12003).

The factor structure of the TSS is important because there is a need for psychometrically sound assessment tools that can contribute to rigorous evaluations of the effectiveness of geriatric interdisciplinary team training interventions. To some

extent, the credibility of the claim that a training intervention is successful is determined by the quality of the tool(s) used to assess outcomes. This study furthers the accumulation of evidence about the Scale's validity. Additionally, this study is unique in that there are currently no known valid team skills self-efficacy instruments.

A psychometrically sound self-scale that measures a trainee's self-efficacy in terms of team competencies would be a valuable contribution because self-efficacy measures are not subject to the primary criticisms associated with paper-and-pencil tests that purport to measure skill mastery. The first criticism is that the only feasible way to measure skill -- team or otherwise -- is through observation of individuals as they perform tasks that require using a given skill set (Brannick, et al., 1993). This criticism is particularly true in healthcare settings where experiential learning and clinical rotations serve as the vehicle for skills acquisition and demonstration of abilities. The other criticism is that a instruments are more likely to measure knowledge rather than skills (Miller, 2001). However, a scale that measures team skills self-efficacy is not subject to this criticism because according to Bandura (1997) self-efficacy measures task specific self-perception of what she/he can do.

There is a large body of research indicating that self-efficacy is a strong predictor of what an individual can do as well as a predictor of future behavior (Pajares, 2003). However, the relationship between self-efficacy and healthcare practitioners' behavior has not been established; but, may be a promising direction for future research. Extrapolating from Pajares' (2003) finding, it is expected that team skills learners with

high task-specific self-efficacy are more likely to use those skills in team settings than are learners who believe they are not capable of performing team skills.

Findings

The Model of Individual-Level Team Competencies (Model of I-LTC), as proposed in Chapter 2, served as the conceptual rationale used to guide evaluation of the factorial validity of the TSS. The purposes of the conceptual model were to: 1) lay out the underlying logic of individual-level team competencies; 2) use that logic as the guiding framework for exploring competencies that individuals should possess in order to be effective members of interdisciplinary healthcare teams; and 3) specify a priori the structure of the TSS.

Two research hypotheses were formulated to evaluate the factor structure of the TSS and one hypothesis was developed to analyze a covariance structure model of the validated TSS. Each hypothesis is discussed below.

Hypothesis 1: The Team Skills Scale (TSS) is a first-order two-factor structure (leadership communication skills and technical/professional abilities).

The Model of I-LTC posits that the competencies that each individual brings to the process influences team interaction. In turn, team interaction influences team effectiveness. The Model suggests that individual-level team competencies are composed of three constructs: knowledge, leadership communication skills and technical/professional abilities.

Hypothesis 1 proposed that two (leadership communication skills and technical/professional abilities) of the three model constructs are operationalized by the

TSS. Confirmatory factor analysis (CFA) results did not support Hypothesis 1. Rather, CFA results suggested that the TSS measures only one underlying factor. This does not mean that the conceptual model is not correct. Rather, it only implies that a plausible model of the TSS operationalizes only one factor. CFA results also suggest that the underlying factor is best represented by eight of the original 17 Scale items. The eight items are:

1. Treat geriatric team members as colleagues (VTSS2);
2. Strengthen cooperation among disciplines (VTSS7);
3. Address clinical issues succinctly in interdisciplinary meetings (VTSS9);
4. Develop an interdisciplinary care plan (VTSS11);
5. Adjust your care to support the team goals (VTSS12);
6. Develop intervention strategies that help patients attain goals (VTSS13);
7. Raise appropriate issues at team meetings (VTSS14); and
8. Intervene effectively to improve team functioning (VTSS16).

It is believed that the one factor operationalized by the 8-item TSS is self-perceived team collaboration skills. According to Tsukuda and Stahelski (1990) collaboration is an individual's process of interaction and internalized attitudes. Tsukuda and Stahelski (1990) stated, "The collaborative (cooperative) individual should recognize that her or his outcomes are dependent on the efforts of other (as well as her or his own); that others in the long run will not tolerate exploration; that cooperative behavior on the part of the others is best stimulated by initiating cooperation; and that trust of others is an essential ingredient to a cooperative relationship" (p 1).

As operationalized by Tsukuda and Stahelski (1990), the term collaboration is synonymous with the term cooperation. Also of note is that "process of interaction" is a broad concept that could include a wide range of operational definitions. Tsukuda and Stahelski identified eight operational definitions for collaboration and seven of these items might be associated with the 8-item TSS. These associations are believed to be as follows:

1. "Express personal goals consistent with team goals" may be associated with VTSS9 & VTSS14 ("Address clinical issues succinctly in interdisciplinary meetings" and "Raise appropriate issues at team meetings").
2. "Advocate problem solutions that benefit all team members" could be associated with VTSS12 ("Adjust your care to support the team goals").
3. "Work for consensus" could be associated with VTSS16 ("Intervene effectively to improve team functioning").
4. "Cooperate with other team members' tasks" could be associated with VTSS7 ("Strengthen cooperation among disciplines").
5. "Do an equitable share of the group workload" could be associated with VTSS11 ("Develop an interdisciplinary care plan").
6. "Feel an individual responsibility for the joint outcomes of the group members" could be associated with VTSS12 ("Adjust your care to support the team goals").
7. "View my contribution as belonging to the group, to be used or not, as the

group decides" could be associated with VTSS2 ("Treat geriatric team members as colleagues").

One item "Support the team in dealing with the larger organization" does not appear to be associated with the TSS.

Collaboration was not included among the possible operational definitions of the leadership communication skills factor or the technical/professional abilities factor in the Model of I-LTC. Collaboration skill should be added to future versions of the model as a potential operational definition of the leadership communication skills factor.

Leadership communication is about sharing enough meaning to positively influence members to move in the direction of the team's goals (Cragan & Wright, 1999). This definition implies relationship-oriented and the collaborative skills that are acquired through spoken and unspoken communication processes such as expressing personal goals consistent with team goals and advocating problem solutions that benefit all team members. All interaction involves some form of communication. Thus, communication is the vehicle that team members use to collaborate and to accomplish much of its mission.

The initial TSS measurement model (two factors and all 17 items) proposed that three (VTSS11, VTSS12 and VTSS13) of the items retained in the revised 8-item measurement model operationalized the technical/professional abilities construct. However, it was found that these three items do not operationalize technical/professional abilities as was proposed by the Model of I-LTC.

While patient care planning (VTSS11 and VTSS12) and developing intervention strategies (VTSS13) are still believed to be technical/professional abilities, it seems clear that these three TSS items do not tap the proposed factor. Additionally, the very high correlations among the 17-item TSS (Cronbach's alpha = 0.95) further confirms a single dimension for this instrument.

It is possible that the three items (VTSS11, VTSS12 and VTSS13) focus on the collaborative process rather than behaviors associated with performing core technical functions. For example, developing a patient care plan requires knowledge about the various aspects of the planning process bundled with the ability to translate knowledge into performance behaviors.

In summary, the first research hypothesis is rejected. The TSS is one dimensional with characteristics of both factors (leadership communication skills) rather than bi-dimensional (leadership communication skills and technical/professional abilities) as originally hypothesized. Additionally, the plausible CFA model includes only eight of the original 17 TSS items and there were seven correlated errors among the eight residuals. The correlated errors most likely represent a high degree of overlap in item content which was also indicated by a strong positive value for Cronbach's alpha (0.91). This means that there is still redundancy between the eight Scale items. For example, it is theoretically reasonable that "Treat geriatric team members as colleagues" and "Strengthen cooperation among disciplines" operationalize the same underlying construct.

It is also possible that social desirability responding is responsible for the correlated errors. Specifically, GITT trainees were volunteers. Thus, it is conceivable that they possessed favorable beliefs about interdisciplinary teamwork and their own team skills prior to the training intervention. In fact, the GITT pretest data provides evidence that supports this possibility. Although more than three-fourths of trainees had no prior team training experiences, the vast majority of trainees self-rated as having "good" to "very good" team skills as measured by the TSS pretest scores.

Hypothesis 2: Performance of the plausible TSS measurement model will replicate when the GITT data are divided into two random samples.

Hypothesis 2 proposed that the plausible TSS would cross-validate (replicate) with random samples of the GITT data. In particular, GITT data were randomly divided into two samples each containing 590 cases and then their fit to the CFA model was simultaneously estimated for equivalence of the factor structure across samples. Establishing evidence of the equivalence of the factorial structure across samples was necessary because post hoc modifications (deleting items and correlated errors) might have capitalized on chance. The analysis demonstrated the stability of the factorial structure of the revised TSS across the two random samples. This finding provides strong evidence that the same construct has been measured across different groups as represented by the samples. Thus, there is a low probability that post hoc modifications resulted in a plausible factorial structure by chance alone. Therefore, Hypothesis 2 is accepted.

However, acceptance of this hypothesis does not mean that there is measurement invariance across groups by gender, race/ethnicity, various health professions and other key group differences. The revised TSS still needs to be examined for potential group performance differences to establish appropriate uses of the scale. A fuller discussion of this issue is provided in this chapter in the section on limitations of the study, item four.

Hypothesis 3: Student trainee age, attitudes about the physician's team role and attitudes about the quality of patient care that is delivered by teams are predictors of self-perceived team skills as measured by the plausible TSS measurement model.

Hypothesis 3 proposed that trainee age and teamwork attitudinal variables are predictive of self-perceived team skills. Covariance structure model results showed that while attitudinal exogenous variables were statistically significant, age was not a statistically significant exogenous variable. Therefore, Hypothesis 3 is accepted, in part.

Although some practitioners believe that age is a team skill explanatory variable, no published empirical studies have examined the relationship between age heterogeneity and team interaction, performance and/or self-perceived team skills. It is conceivable that age is a proxy for one or more other variables such as career stage, technical expertise, perceived professional status, professional role, or prior team experience.

Moreover, while the age distribution among team members might influence the team's interaction style this group level phenomenon does not necessarily apply when the individual is the unit of analysis. The assumption that the age of team members influences self-perceived team skills is not supported in this study.

On the other hand, attitude is often influenced by an individual's knowledge and beliefs (perceptions). Some research shows that there is a strong link between attitude and self-efficacy (Ajzen & Madden, 1986; Delcourt & Kinzie, 1993; Regan & Fazio, 1977; Rigges & Enochs, 1993). Additionally, attitude is believed to motivate and guide an individual's behavior and there is evidence that attitude predicts behavior (Ajzen & Fishbein, 1980; Ajzen, 1991; Bandura, et al., 1977).

Results for Hypothesis 3, provides evidence that team skills self-efficacy predicts attitude. If team skills self-efficacy predicts attitude and both attitude and self-efficacy predict behavior, it is possible that together these two measures can serve as a proxy for Level 3 training evaluation as specified by Kirkpatrick (1998a).

A Level 3 training evaluation assesses the transfer of the learned skills to the practice environment (work). Evaluation at this level attempts to answer the question - Are the newly acquired skills, knowledge, or attitude being used in the everyday environment of the trainee? Some funding sources consider this evaluation level the truest assessment of a program's effectiveness. However, measuring at this level is difficult and resource intensive. Also, it is often not possible to extend the assessment into the work environment. Thus, a valid self-efficacy instrument would provide credible alternative for predicting expected change in work place behaviors as a result of a training intervention.

Implications

Three key implications of these findings are discussed in this section. First, the 17-item TSS is purported to measure three factors: interpersonal skills, discipline-specific

skills, and geriatric care skills (Hyer, et al., 2002). However, there are no subscales nor does the recommended item scoring explicitly account for each of the three factors purportedly measured. Additionally, the 17-items are highly correlated (Cronbach's alpha = 0.95) and are likely operationalizing the same underlying construct. CFA results support a uni-dimensional structure, but not with all 17 items. Thus, the 17-item TSS should not be accepted as a valid measure of self-perceived team skills (interpersonal skills, discipline-specific skills, and geriatric care skills) as posited by the Scale's authors.

The second implication is that there is empirical evidence supporting the factorial validity of the revised version of the TSS that retains one factor and eight of the original 17 items. However, the revised TSS does not appear to operationalize self-perceived leadership communication skills as posited by this author. Rather, it is possible that the eight-item TSS taps a trainee's self-perceived team collaboration skills. The present study represented one additional step toward realizing insights about self-perceived geriatric interdisciplinary healthcare team skills. However, the revised TSS is not ready for immediate application as a training evaluation tool. Replication of study results using data gathered from other samples and other team training settings is essential for establishing the factorial validity of revised Scale. Additionally, content validity studies should be conducted to build consensus about what the Scale actually measures.

The third implication is related to the finding that team member attitudes about the physician's team role and attitudes about the quality of patient care delivered by a team were found to significantly predict variation in responses to TSS items. Although this is the first known empirical support for the influence of attitude on self-perceived

team skills, some teamwork researchers and practitioners have postulated that such a relationship is probable (Drinka & Clark, 2000; Heinemann, et al., 1999). Intuitively, this seems reasonable because attitude represents an individual's desire to participate in an activity (Ajzen, 1991). Thus, an affirmative desire is likely to result in behaviors that facilitate acquisition of competencies. This implies that trainers may be able to facilitate the desired training outcomes through strategies that promote positive attitudes towards the learning objective.

Theoretical Considerations

Although, the Model of I-LTC is a step forward in clarifying the conceptual framework for teamwork competencies when the individual is the intended unit of analysis, the lack of empirical evidence about its validity means that the model's theoretical utility is yet to be substantiated. Therefore until the Model of I-LTC is validated, it can only be used as a framework for understanding the concepts and language of individual-level team competencies. The Model can guide future development and testing of instruments designed to capture teamwork competencies. This means that once the psychometric properties of the TSS have been well established, there will still be a need for a theoretical training model to which the instrument can be linked. The instrument can then be used to operationalized an aspect of the training model.

The advantage of a validated self-efficacy instrument is its potential to predict behavior and thus may serve as proxy for Kirkpatrick's Level 3 evaluation. The Kirkpatrick training evaluation model (1998a) consists of four levels of training

outcomes and each level possesses unique traits. The model implies a hierarchical continuum of outcomes that can be used to assess the effectiveness of a training intervention.

The evaluation continuum is considered hierarchal because information from each prior level serves as a base from which to build the next evaluation level. Additionally, as the evaluation process moves forward along the continuum, each subsequent level represents a more precise measure of the effectiveness of the training program and generally requires a more rigorous and time-consuming assessment process.

Many training evaluations use questionnaires to assess change in participant reactions and feeling about the training (Level 1 of Kirkpatrick's model). Usually, the purpose is to discover how satisfied trainees are with the training program. Kirkpatrick (1994) noted that one purpose of a Level 1 evaluation is to obtain valuable feedback about possible improvements to the training program. Level 1 evaluation has implications for learning (Level 2) because a negative reaction tends to reduce the possibility of learning. However, participant reaction does not demonstrate ability to perform the skill(s) that are at the root of most training interventions. Also, there is no empirical evidence demonstrating that training satisfaction is associated with knowledge, skills and abilities transfer to practice settings.

Level 2 training evaluations assess change in knowledge and/or attitude. According to Kirkpatrick (1994), it is important to measure learning because no change in behavior can be expected unless there has been knowledge gain and a positive change in attitude towards the training content. Knowledge gain and attitude change are usually

assessed using content specific instruments. However, what one knows is not predictive of what one can do (Bandura, 1997). On the other hand, attitude predicts behavior (Ajzen, 1991) in some situations. A common limitation associated with Level 2 evaluations is the use of instruments that do not have strong empirical evidence for reliability and validity.

At Level 3, the evaluation process seeks to assess actual on-the-job behavior. A common training evaluation question at this level is concerned with whether the newly acquired knowledge, skills, and attitude are being used in the everyday work environment of the learner. Kirkpatrick (1994) acknowledges the difficulty of collecting Level 3 evaluation data because of the resources that would be required for on-the-job assessment and because it is often not possible to predict when the change in behavior will occur. Additionally, it is often not possible to control for the vast number of intervening factors that may influence actual job performance or the perceptions of others about the impact of a training intervention on a colleague's performance.

A Level 4 evaluation approach involves the assessment of patient outcomes that are related to the training intervention. This evaluation approach attempts to measure improvement in patient care which is usually the overarching goal of the training intervention. However, as with a level 3 evaluation, this approach is difficult to measure, is resource intensive and is rarely attempted.

Critics of the Kirkpatrick training evaluation model often note that the model is not a cohesive theoretical framework; rather it is taxonomy. More importantly, there has been no empirical evaluation of the model to either support or refute the hierarchical

relationship between the model's four levels. Further, although the four evaluation levels are intuitively reasonable, the predictive relationship between the levels has not been established. However, rather then abandon Kirkpatrick's model some researchers have used it in conjunction with theoretical models that have established empirical track records. One such theory is Ajzen's (1991) Theory of Planned Behavior.

The Theory of Planned Behavior establishes a basis for predicting individual behavior. The theory posits that performance of a behavior is determined by the individual's feelings and evaluation that the behavior will produce positive consequences. This theory has been used to explain behavioral change in response to training interventions (Fishbein & Stasson, 1990) as well as a range of other behaviors (Ajzen 1996). Additionally, more recent uses of Ajzen's theory explicitly operationalize perceived behavioral control, a key concept, using self-efficacy instruments (Godin & Kok, 1996). Perceived behavioral control refers to the person's perceived confidence in her/his ability to perform a behavior (Ajzen & Madden, 1986).

It is proposed that the Theory of Planned Behavior may prove useful for understanding factors underlying the potential for transfer of competencies from the training environment to the job setting. Also, when the theory's perceived behavioral control construct is operationalized using a valid self-efficacy instrument, the likelihood of predicting on-the-job behaviors as a result of the training intervention may be significantly improved.

This suggests that when the objective of a training intervention is to bring about change in on-the-job behaviors, this theoretical foundation offers an approach for

conducting what Kirkpatrick's referred to as a Level 3 training assessment without the need for collecting pre/post training data within the actual job setting. Therefore, all of the difficulties related to on-the-job data collection, such as controlling intervening factors that may influence actual job performance, are avoided because the assessment data are collected, using valid self-efficacy instruments, before the trainee returns to the work setting.

Limitations of the Study

Despite the contributions of this research to geriatric interdisciplinary healthcare team training assessment, there are a number of factors limiting the generalizability of study results.

1. GITT was designed to be a pretest/posttest quasi-experimental training intervention. As such, the data are subject to the threats to internal validity that are classically associated with these research designs, particularly those threats related to participant selection. The sample was composed of individuals who self-selected by volunteering to participate in GITT training and GITT volunteers may have been predisposed to facilitating the program's intent.

   All threats to internal validity can be overcome by using a true experimental design in which subjects are assigned at random to experimental and control conditions. The switching replications design is especially useful for evaluating training outcomes. This design solves the problem of denying training to some participants (control group) because both experimental and control groups receive the training intervention, just staggered during the implementation of training.

Specifically, the intervention is applied in stages. First, pretest measures are obtained for both groups. Next, the experimental group receives training and measurement is taken for both groups. Then the experimental group and control group switch roles and training is implemented for the former control group. Both groups are again measured. By the end of the training intervention, there will be three waves of measurement and both groups will have been trained (Trochim, 2001).

2. The Scale was developed 'atheoretically' and as a result there are likely a number of important teamwork skills that were not operationalized by the TSS. Atheoretical Scale development gave rise to post hoc rationalizations about what the revised TSS actually measured. Specifically, it is believed that the revised Scale measures team collaboration skill and that collaboration skill should now be included in the Model of I-LTC as an operational component of the Leadership Communication Skills construct. Although the revised TSS shows some promise as a measure of team collaboration self-efficacy, there remains a need to further validate the Scale's content.
3. There is no existing team skills scale instrument to serve as the gold standard (criterion-related validity). Thus, the process for determining the degree of confidence that can be placed on to the revised Scale will be longer than would be needed if there were already a well established measure of self-perceived interdisciplinary team skills (collaboration skills).
4. Although the revised structure of the TSS was corroborated by the data, this does not mean that the factorial structure of the instrument is absolute. It just means that the

structure has not been falsified. The best way to mitigate this limitation is to further evaluate the factor structure of the TSS using data gathered from other training interventions and by establishing the performance of the instrument for a variety of potential target groups (testing for measurement invariance).

The methodological study conducted by Mark and Wan (2005) offers a comprehensive view on assessing factor invariance of a measurement instrument, particularly instruments that use Likert-type scales. To determine the level at which measurement equivalence no longer exists; Mark and Wan (2005) demonstrate how to assess five forms of measurement equivalence and/or invariance. Testing for the five types of invariance would offer a more rigorous way to assess reliability and validity of the TSS. Additionally, assessing all five forms of invariance would more fully identify which, if any, group characteristics produce differential performance of the TSS.

Directions for Future Research

A number of issues were raised in this study which could stimulate future research. Seven research areas are identified as discussed below.

1. Researchers may want to conduct studies that correct limitations as identified above. These limitations include not using an experiential design, need for further content validation of the revised TSS and further evaluation of the factor structure of the revised TSS using data gathered from other training interventions and for a variety of potential target groups. Specifically, is there differential performance of the TSS across factors such as gender, discipline, years of healthcare experience, age, and

prior teamwork experience? Resolution of this issue would further define the appropriate audience for use of the instrument.

2. Wording of TSS items should be revised to comply with Bandura's (2001) recommendation for wording self-efficacy items. Scale items should be phrased to capture what the individual perceives she/he "can do" at the time the instrument is administered because "can" represents judgment of capability. Therefore, each TSS item should lead with the following wording "How well can you ..." For example, the best wording for item 7 would be "How well can you strengthen cooperation among disciplines?" and the best wording for item 16 would be "How well can you intervene to effectively improve team functioning?"
3. The revised and uni-dimensional TSS measures only a very limited number of teamwork competencies. However, the Model of I-LTC posits that individual-level teamwork competencies (knowledge, skills, abilities, and predisposing factors) is a multi-dimensional view of. Therefore, there is still a need for research that contributes to identifying the full spectrum of competencies essential for individuals to become effective team members. The full spectrum should operationalize each of the three constructs (knowledge, leadership communication skills and technical/professional abilities) specified by the model of I-LTC.

Heilman's (1977) study continues to be the most comprehensive analysis in this area and may serve as the foundation for a Delphi study to identify the full range of geriatric interdisciplinary team competencies. Heilman identified 52 competencies that were rated as either of highest importance for team success (n = 17) or of

moderate importance (n =35). For example, security in one's perceived team role, ability to defend one's professional input, and ability to separate important decisions from trivial matters are not included in the revised TSS, but may be important skills for promoting effective team interaction. Identification of the full spectrum of individual-level team competencies is a necessary first step towards understanding the contribution of individual team members to team interaction and ultimately team effectiveness.

4. Most small group theories focus exclusively on the group as the unit of analysis and the role of individual-level competencies has received little attention. This omission, to some extent, reflects the complexity of the team literature and the lack of shared meaning for terms used in team research and practice (Drinka & Clark, 2000; Forsyth, 1998; Heinemann & Zeiss, 2002). Researchers have generally neglected to explore and explicate the relationship between competencies focused on the individual as the unit of analysis and competencies that are focused on the team as the unit of analysis. For the most part, teamwork taxonomies have been developed with a focus on the team as the unit of analysis. What, if any, differences exist between individual-level competencies and the skills exhibited by the team as a whole?

   This is not just a unit of analysis issue because if individual proficiency is needed before unit/team can be effective, what are the most effective instructional techniques for training teamwork competencies? Evidence is needed to determine whether team experience itself provides the knowledge, skills, and abilities needed to be an effective team member. Further, which individual competencies can be learned

during actual team experiences and which individual competencies are more effectively learned using other training methods such as case studies, lecture, observation, and role play.

5. The relationship between self-efficacy, attitude and behavior needs more study. Ajzen's Theory of Planned Behavior offers a useful framework for teasing out the relationships between these three variables. When self-efficacy is operationalized as a task and domain specific measure as suggested by Pajares (2003), self-efficacy has been shown to be a valid predictor of behavior in many situations such as. However, self-efficacy has not been well studies in healthcare setting where the behavior of healthcare professionals is the focus of the study. These relationships should be studied to determine whether self-efficacy is correlated with training outcomes for healthcare students and practitioners.

If the correlation between self-efficacy and training outcomes can be substantiated, self-efficacy may serve as reasonable proxy for what Kirkpatrick identified as a Level 3 training evaluation. Empirical evidence demonstrating a correlation between team skills self-efficacy, attitude towards team work and on-the-job behaviors would facilitate training evaluations that span the continuum of Kirkpatrick's model.

There is a large body of research indicating that self-efficacy is a strong predictor of what an individual can do as well as a predictor of future behavior (Pajares, 2003). However, the relationship between self-efficacy and healthcare practitioners'

behavior has not been established. This may be a promising direction for future research.

6. In the course of studying the team literature, it was clear that most researchers depended on their own discipline to provide the framework from which to work and in many cases completely ignored empirical evidence from other disciplines. This practice has created discipline specific team language, team theories, and accumulated knowledge about teams. Additionally, this practice has contributed to the ambiguity, abstractness, and disagreement that surround the team phenomena (Drinka & Clark, 2000; Forsyth, 1998; Heinemann & Zeiss, 2002). However, examining the theoretical perspectives of other disciplines could lead to shared definitions of relevant constructs and could facilitate generalizable understanding about teams.

   The usual justification for not embracing the work of other disciplines is couched in terms of differences in the team's purpose, structure, leadership, degree of interdependence, coordinated effort, and power parameters. Also, the complexity of patient healthcare needs is often cited as a factor precluding the adoption of evidence from other disciplines.

   Further, Drinka and Clark (2000) argue that interdisciplinary healthcare teams are different from other healthcare care teams where the efforts of each discipline occur in a parallel or sequential manner: there may be little or no awareness of the efforts of other disciplines and patient care decision-making is vested in one person, usually the physician, rather than the team (Garner & Orelove, 1994).

Nonetheless, it is likely that there are some teamwork competencies that transcend discipline and the type of team. Discovery of competencies that may be generic to the team phenomena will require the accumulation of evidence based on transdisciplinary research efforts.

7. Finally, there is a need to ground the Model of I-LTC in empirical research, assess its completeness, establish the predictive relationship between model constructs, and to expand the Model's theoretical underpinning. Once this has been accomplished, the Model could be used to guide the development of global or task specific individual-level teamwork competency instruments. Collaboration was not included among the possible operational definitions of the leadership communication skills factor or the technical/professional abilities factor in the Model. Perhaps, collaboration should be added to future versions of the model as a potential operational definition of the leadership communication skills factor.

A literature search found no existing models of individual-level team competencies. A validated conceptual model of individual-level team competencies could be useful beyond the current study in furthering an evidence base that may eventually provide insights about curricula that best equip students with the knowledge, skills, abilities, and attitudes they will need for effective interactions with other team members. The competencies also can guide effective instruction and assessment. The model could also serve as a springboard for further work in operationally defining variables or describing skills.

Conclusions

The use of interdisciplinary healthcare teams, particularly in geriatrics, is an adaptive response to ongoing changes in healthcare delivery systems in the U.S. The complex medical and psychosocial needs of some patients have led many healthcare leaders to call for the use of interdisciplinary teams as a key strategy for fostering patient centered healthcare. In fact, first rate geriatric care has been defined as interdisciplinary team care by some healthcare leaders such as The John A. Hartford Foundation.

To become effective interdisciplinary team members, healthcare professionals must receive training in teamwork competencies. Therefore, it is important to understand what makes teams effective so that the essential knowledge, skills, and abilities (KSAs) can be developed, included in interdisciplinary team training curricula and learning outcomes measured using valid and reliable instruments.

There is empirical evidence that supports the efficacy of both interdisciplinary team care and interdisciplinary team training programs. For example, some randomized clinical trials suggest that interdisciplinary team care results in improved outcomes for some older adults; to include, increased survival, improved physical function, significantly greater improvement in health perception, and increased likelihood of living at home for patients. Interdisciplinary team training programs have been reported to result in innovations in team training, diffusion of curricula throughout healthcare academic programs, and positive attitude change toward the competence and professional contributions of other disciplines.

However, much more evidence is needed to conclusively establish the efficacy of the interdisciplinary team approach to patient care and to document outcomes of interdisciplinary team training programs. One necessary component of a strong evidence base about the effectiveness of training outcomes is the use of valid and reliable measurement tools. Yet, there are few scales with known validity and reliability to document interdisciplinary team training outcomes to include the transfer of learning to the practice environment.

The purpose of this study was to assess the factorial validity of the Team Skills Scale (TSS). Team skills are the competencies (knowledge, skills and abilities) needed to perform specific tasks. Competencies are developed through learning experiences and mastery is assessed through training evaluation.

This study found that the TSS in a single factor structure comprised of eight of the original 17 TSS items and that the eight items are believed to measure self-perceived team collaboration skills. Although the factor structure was confirmed by the data, this does not mean that the proposed structure is absolute. It just means that the structure has not been falsified. Also, this constellation of indicators may be data driven. Therefore, further psychometric testing, to include the use of other data sources, is recommended.

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Appendix A.

VCU Institutional Review Board (IRB) approval letter

MCV Campus

Virginia Commonwealth University

Office of Research Subjects Protection

Sanger Hall, 1-023
1101 East Marshall Street
P.O. Box 980568
Richmond, Virginia 23298-0568

804 828-0868
Fax: 804 827-1448
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DATE: August 5, 2005

TO: Iris A. Parham, PhD
Gerontology
Box 980228

FROM: William E. Smith, PharmD, MPH, PhD
Chairperson, VCU IRB Panel A
Box 980568

RE: **VCU IRB #: 6013**
Title: Factorial Validity of the Team Skills Scale

On August 5, 2005, the following research study ***qualified for exemption*** according to 45 CFR 46.101(b) Category 4. This determination includes the following items reviewed by this Panel:

RESEARCH APPLICATION/PROPOSAL: None

PROTOCOL: Factorial Validity of the Team Skills Scale (received 7/19/05)

ADDITIONAL DOCUMENTS: None

This Institutional Review Board is in compliance with good clinical practices (GCP) as defined under the U.S. Food and Drug Administration (FDA) regulations and the International Conference on Harmonization (ICH) guidelines. Virginia Commonwealth University is approved by DHHS to conduct human subjects research under a Federal Wide Assurance #FWA00005287. **All correspondence related to this research study must include the IRB protocol number and the investigator's name(s) to assist us in locating your file.**

The Primary Reviewer assigned to your research study is Thomas Eissenberg, PhD. If you have any questions, please contact Dr. Eissenberg at teissenb@vcu.edu or 8284617; or you may contact Stephan Hicks, IRB Coordinator, VCU Office of Research Subjects Protection, at hickssa2@vcu.edu or 828-9876.

Attachment – Terms of Approval

Appendix B.

Missing Data Case Numbers

Table 31

Identification Numbers for Cases Missing Data on All 17 Team Skills Scale Pretest Items

A7117	M4301
A8643	M4371
B6925	M8224
B7322	M8597
B9327	N7958
C0139	N8563
C2333	O6232
C3835	O7231
C5851	P9073
C7621	R0189
D3575	R0763
F6859	R6467
F8646	R7262
G1114	R7459
G3651	S2364
H3973	T9618
J8783	V0963
K0205	W2334
K0690	W3105
K2618	W5316
K2852	W5940
L1063	W6659
L3734	W9855
M4121	W9949

Table 32

Case Identification Numbers and the Value of Mahalanobis Distance for Each Multivariate Outlier

Case ID	MAH_1 Mahalanobis Distance	Case ID	MAH_1 Mahalanobis Distance
N6755	40.932	G7935	46.962
B9313	41.415	P8990	47.172
C3941	41.425	A8208	48.249
E8366	41.512	M7172	48.373
H1326	41.829	W0331	48.602
P3573	41.849	W9532	49.645
L2973	41.872	W6303	49.965
A3509	41.971	K8734	50.220
R0265	42.592	B6640	51.271
W2938	42.665	R6497	52.067
M1844	43.040	S1829	53.625
M8232	43.045	D0893	54.412
B6062	43.087	S6338	56.011
J4272	43.449	I0135	57.417
S4970	44.271	B2876	61.709
C6745	45.339	R9875	63.500
S7348	45.493	L9802	64.835
S2586	45.606	P2335	73.395
H2865	45.694	P1309	78.969
G8552	46.879	M2252	86.612

Vita

Myra G. Owens was born to Rosalyn and Charles Owens on May 6, 1951, in Baltimore, Maryland, and is an American citizen. After earning an Associates Degree in General Studies in 1975 from the Community College of Baltimore (now known as Baltimore Community College), she gradually earned a Bachelor of Arts in History in 1991 from Regents College, The University of the State of New York (now known as Excelsior College). Throughout her academic pursues, she supported herself first as a Radiologic Technologist (1972-1976, & 1991-1995), then as an officer in the United States Army Quartermaster Corps (1976-1991). In 1996, she earned a Master of Science in Gerontology from Virginia Commonwealth University, Medical College of Virginia Campus. Since 1996, she has held a number of policy research, statistics, and program evaluation positions. Myra is currently employed as Lead Analyst Research and Evaluation at the Virginia Department of Rehabilitative Services.